NFPA®

1123

Code for Fireworks Display

2026

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NFPA® 1123

Code for

Fireworks Display

2026 Edition

This edition of NFPA 1123, *Code for Fireworks Display*, was prepared by the Technical Committee on Pyrotechnics. It was issued by the Standards Council on April 12, 2025, with an effective date of May 2, 2025, and supersedes all previous editions.

This edition of NFPA 1123 was approved as an American National Standard on May 2, 2025.

Origin and Development of NFPA 1123

The development of NFPA 1123 began in 1975 with the submission to the Technical Committee on Pyrotechnics of a proposed standard drafted by the American Pyrotechnics Association. The proposed standard was redrafted and was officially adopted by the National Fire Protection Association at its 1978 Fall Meeting. The 1978 edition was amended in 1980, and the amended version was adopted by the Association at its 1981 Fall Meeting.

In the 1990 edition of NFPA 1123, the Committee initiated a complete revision of the document that incorporated a good deal of additional detail on the operation of outdoor fireworks displays, including enhancements to safely conducting outdoor fireworks displays by increasing the audience separation distances. The Committee also addressed the new technology of electrically firing outdoor firework displays. Generally, the Committee provided performance requirements rather than specific, prescriptive requirements.

The 1995 edition of NFPA 1123 included partial amendments to the document, as well as editorial revisions to improve its ability to be used, adopted, and enforced and to make it conform with the *Manual of Style for NFPA Technical Committee Documents*. The Committee updated the definitions used for fireworks to be consistent with the terminology used in the US Department of Transportation regulations that incorporated the United Nations' shipping designations for fireworks (explosives), including the marking of aerial shells. The 1995 edition also included a new chapter with requirements for electrically firing fireworks displays and refined the provisions for manually firing large-diameter aerial shells.

The 2000 edition of NFPA 1123 contained three significant changes. First, a new Chapter 4 on display fireworks launched from floating vessels and floating platforms was added. It provided guidance on the construction, sizing, operation, and egress requirements for those fireworks displays launched from floating vessels and floating platforms. Second, requirements for mortar installation and placement were added. The third significant change was a revision and expansion of the tables in Annex A covering mortar wall thickness for steel, paper, high-density polyethylene (HDPE), and fiberglass mortars. Chapter 2 was also reorganized into a more logical sequence.

The 2005 edition contained three major revisions to the code. The Committee added smaller aerial shell sizes to the separation distances table in Chapter 5 and reorganized Chapter 5 to clarify the requirements for the various shell types. The reorganization of the chapter established clear requirements for aerial shells, mines and comets, and ground display pieces. The 2005 edition also included new guidance on displays from rooftops and other limited or restricted access sites. The code was also reorganized according to the *Manual of Style for NFPA Technical Committee Documents*.

The 2010 edition incorporated minor revisions to definitions, requirements for the protection of ready boxes, and requirements for determining the fallout area and display site. The Committee also amended requirements pertaining to single-break aerial salute shells; requirements pertaining to handling live components or unexploded shells; and requirements for angling aerial shells, comets and mines, and Roman candles and cakes.

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The 2014 edition incorporated several revisions to definitions and included provisions for separation distances for marine preparation areas. It also increased spectator distances for elevated display sites in the spectator section of the code. Annex material was also added for clarification of these separation distances.

The 2018 edition incorporated a number of changes to clarify existing requirements and added new requirements to the code based on changes in the industry. Changes were made in a number of sections to address the stability of pyrotechnic devices and mortars, including prohibiting the use of plastic or zip ties to secure devices. Performance requirements were added for rack construction and materials to ensure that systems can function as designed and to protect the technicians and the public from injury should a catastrophic malfunction occur.

A new subsection 4.7.1 was added to address the increasing use of densely packed trailers, which are increasingly used for firing pyrotechnics. This new subsection includes requirements for the construction material and the security and stabilization of racks on such trailers.

The 2022 edition included new information about multi-sized device spacing to address the separation distances required when such devices are used in one location. As long as the minimum separation distance is met for each device, it can be placed anywhere in the display site.

In addition, requirements for flammable liquid fireball effects were added to provide the appropriate separation distances for pyrotechnic special effects at display sites.

The 2026 edition of the code continues the previous work applicable to flammable liquid fireball effects and has been expanded to cover solid fuel fireball effects. Additional requirement for barges and floating platform displays have also been added to further clarify who can assign other duties to the display crew and clarify temporary structures and barriers on barges or floating platforms. Labeling requirements for professional-use-only products and a definition of *pyrotechnic professional* have been added to cover those products that fall between Consumer Product Safety Commission and alcohol, tobacco, and firearm regulations.

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Code for

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2026 Edition

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

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Information on referenced and extracted publications can be found in Chapter 2 and Annex G.

Chapter 1 General

1.1 Scope.

1.1.1 This code shall apply to the following:

(1) Construction, handling, and use of fireworks and equipment intended for outdoor fireworks display
(2) Operation of the display *(See 3.3.16, Fireworks Display.)*

1.1.2 This code shall not apply to the following:

(1)* Manufacture, transportation, or storage of fireworks at a manufacturing facility
(2) Testing of fireworks under the direction of their manufacturer, provided that permission for such testing has been obtained from the authority having jurisdiction (AHJ)
(3) Use of consumer fireworks by the public
(4) Transportation, handling, or use of fireworks by the armed forces of the United States
(5) Transportation, handling, or use of industrial pyrotechnic devices or fireworks, such as railroad torpedoes; fusees; automotive, aeronautical, and marine flares; and smoke signals
(6) Use of pyrotechnic devices or materials in the performing arts at distances less than those specified in this code and used in conformance with NFPA 1126
(7) Use of flame special effects in the performing arts when used in conformance with NFPA 160
(8) Sale and use of rockets, rocket motors, motor reloading kits, pyrotechnic modules, or components used in conformance with NFPA 1122 or NFPA 1127, or other propulsion devices classified by the US Department of Transportation as "Rocket Motors" (UN 0186), or "Cartridges, power device" (UN 0275)
(9) Use of explosives, firearms, or flammable special effects used in motion pictures, television, or other entertainment industries

1.2 Purpose. The purpose of this code shall be to provide the following:

(1) Minimum requirements for outdoor fireworks displays
(2) Recommended local permit regulations *(See Annex B.)*
(3) Recommended regulations for state certification of display operators *(See Annex C.)*

1.3 Equivalency. Nothing in this code is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this code.

1.3.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.3.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.4* Enforcement.

1.4.1 This code shall be administered and enforced by the authority having jurisdiction designated by the governing authority. *(See Annex E for sample wording for enabling legislation.)*

1.4.2 The annex sections of this document are not part of the requirements of this NFPA document but are included for informational purposes only.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this code and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 160, *Standard for the Use of Flame Effects Before an Audience,* 2026 edition.

NFPA 306, *Standard for the Control of Gas Hazards on Vessels,* 2024 edition.

NFPA 1122, *Code for Model Rocketry,* 2026 edition.

NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles,* 2026 edition.

NFPA 1126, *Standard for the Use of Pyrotechnics Before a Proximate Audience,* 2026 edition.

NFPA 1127, *Code for High Power Rocketry,* 2026 edition.

2.3 Other Publications.

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2.3.1 APA Publications. American Pyrotechnics Association, 4891 Long Beach Rd., SE, Suite 3, Box 291, Southport, NC, 29461.

APA 87-1A, *Standard for the Construction, Classification, Approval, and Transportation of Consumer Fireworks*, 2018.

APA 87-1B, *Standard for the Construction, Classification, Approval, and Transportation of Display Fireworks*, 2018.

APA 87-1B, *Standard for the Construction, Classification, Approval, and Transportation of Entertainment Industry and Technical (EI&T) Pyrotechnics*, 2018.

2.3.2 US Government Publications. US Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401.

Title 16, Consumer Product Safety Commission, Code of Federal Regulations, Part 1500, "Hazardous Substances and Particles: Administration and Enforcement Regulations."

Title 16, Consumer Product Safety Commission, Code of Federal Regulations, Part 1507, "Fireworks Devices."

Title 18, United States Code, Chapter 40, "Importation, Manufacture, Distribution and Storage of Explosive Materials."

Title 27, Code of Federal Regulations, Part 555, "Commerce in Explosives."

Title 49, Code of Federal Regulations, Parts 171–180, "Hazardous Materials Regulations."

2.3.3 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2020.

2.4 References for Extracts in Mandatory Sections.

NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles,* 2026 edition.

NFPA 1126, *Standard for the Use of Pyrotechnics Before a Proximate Audience,* 2026 edition.

Chapter 3 Definitions

3.1 General.

3.1.1 The definitions contained in this chapter shall apply to the terms used in this code.

3.1.2 Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used.

3.1.3 *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3* Code. A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

3.2.4 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

3.3 General Definitions.

3.3.1* Aerial Shell. A cartridge containing pyrotechnic composition, a burst charge, and an internal time fuse or module that is propelled into the air from a mortar and that is intended to burst at or near apogee.

3.3.2* Assistant. A person who works under the supervision of the pyrotechnic operator.

3.3.3* Barrage. A rapidly fired sequence of aerial fireworks.

3.3.4* Battery. A collection of fireworks devices, such as a group of mortars (finale battery) or a bundle of roman candles (candle battery), fused together in such a manner that they are fired within a short period of time.

3.3.5* Break. An individual burst from an aerial shell, generally producing either a visual effect (stars) or noise (salute).

3.3.6 Cake. A chain-fused firework that propels a series of aerial shell, comet, or mine effects into the air from collectively attached tubes.

3.3.7* Chain Fusing. A series of two or more aerial shells or other firework items fused to fire in sequence or simultaneously from a single ignition.

3.3.8* Comet. A single pellet of pyrotechnic composition that is ignited and simultaneously propelled into the air from a mortar or tube; a comet is self-consuming as it rises into the air and can be designed to split apart.

3.3.9 Device.

3.3.9.1* *Fireworks Device.* Any fireworks designed for use in a fireworks display.

3.3.9.2 *Pyrotechnic Device.* Any device containing pyrotechnic materials or pyrotechnic effect simulation equipment, as described in the following definitions, and capable of producing a special effect as defined in this code. [**1126,** 2026]

3.3.9.2.1* *Pyrotechnic Effect Simulation Equipment.* Equipment that uses a chemical mixture, heat source, and the introduction of oxygen to initiate or maintain combustion and that is used to produce visible or audible effects by combustion, deflagration, or detonation. [**1126,** 2026]

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3.3.10* Electrical Firing Unit. A device that provides and controls the electric current used to ignite fireworks.

3.3.10.1* *Automatic Electrical Firing Unit.* A panel or box that operates automatically to provide the source of electric current used to ignite electric matches.

3.3.10.2* *Handheld Electrical Firing Unit.* A small, handheld unit with manually operated switches that control the flow of electric current to electric matches attached to fireworks devices.

3.3.10.3* *Manual Electrical Firing Unit.* A panel or box with manually operated switches that control the flow of electric current to electric matches attached to fireworks devices.

3.3.11* Fallout Area. The designated area in which hazardous debris is intended to fall after a pyrotechnic device is fired.

3.3.12* Finale. A rapidly fired sequence (barrage) of aerial fireworks, typically fired at the end of a display.

3.3.13* Fire (verb). To ignite fireworks by using a portfire, fusee, electric match, electrical current, or some other means.

3.3.14 Fire Resistive. Refers to properties or designs to resist the effects of any fire to which a material or structure can be expected to be subjected.

3.3.15* Fireworks. Any composition or device for the purpose of producing a visible or an audible effect for entertainment purposes by combustion, deflagration, or detonation, that meets the definition of *Consumer Fireworks* or *Display Fireworks* as set forth in this code. [**1124,** 2026]

3.3.15.1* *Consumer Fireworks.* Small fireworks devices containing restricted amounts of pyrotechnic composition, designed primarily to produce visible or audible effects by combustion, that comply with the construction, chemical composition, and labeling regulations of the US Consumer Product Safety Commission (CPSC), as set forth in CPSC 16 CFR 1500 and 1507, 49 CFR 172, and APA 87-1A, *Standard for the Construction, Classification, Approval, and Transportation of Consumer Fireworks.*

3.3.15.2* *Display Fireworks.* Large fireworks devices that are explosive materials intended for use in fireworks displays and designed to produce visible or audible effects by combustion, deflagration, or detonation, as set forth in 27 CFR 555, 49 CFR 172, and APA 87-1B, *Standard for the Construction, Classification, Approval, and Transportation of Display Fireworks.*

3.3.15.3* *Professional-Use-Only Product.* Fireworks and pyrotechnic special effects materials other than those explicitly marked, designed, designated, or approved as consumer fireworks or novelty devices and intended for use by a pyrotechnic professional as laid out by 49 CFR 172 and APA 87-1C, *Standard for the Construction, Classification, Approval, and Transportation of Entertainment Industry and Technical (EI&T) Pyrotechnics.*

3.3.16 Fireworks Display. A presentation of fireworks for a public or private gathering.

3.3.17 Fusee. A highway distress flare, sometimes used to ignite fireworks at outdoor fireworks displays.

3.3.18* Ground Display Piece. A fireworks device that functions on the ground or functions while mounted securely above the ground (as opposed to an aerial shell that functions in the air).

3.3.19* Hazardous Debris. Any debris produced or expelled by the functioning of a fireworks device that is capable of causing personal injury or unpredicted property damage.

3.3.20 Ignition.

3.3.20.1* *Electrical Ignition.* A technique used to ignite fireworks using a source of electric current.

3.3.20.2 *Manual Ignition.* A technique used to ignite fireworks using a handheld ignition source such as a fusee or portfire.

3.3.21* Lance. A thin cardboard tube packed with color-producing pyrotechnic composition used to construct ground display pieces.

3.3.22* Lift Charge. The composition that propels (lifts) the fireworks device into the air.

3.3.23 Loader. An assistant who loads or reloads aerial shells, comets, or mines into mortars.

3.3.24 Match.

3.3.24.1 *Black Match.* A fuse made from string that is impregnated with black powder.

3.3.24.2* *Electric Match.* An electric device that contains a small amount of pyrotechnic material that ignites when current flows through the device.

3.3.24.3* *Quick Match.* A black match that is encased in a loose-fitting sheath.

3.3.25* Mine. A device containing multiple pyrotechnic effects that are simultaneously ignited and dispersed by a lift charge into the air from a mortar or tube.

3.3.26 Mortar. A tube, closed at one end, from which certain aerial devices are fired into the air.

3.3.27 Mortar Rack. A frame containing one or more mortars.

3.3.28 Mortar Trough. Aboveground enclosure filled with sand or similar material into which mortars are positioned and securely held in place.

3.3.29 Operator. The person with overall responsibility for the operation and safety of a fireworks display.

3.3.30 Portfire. A long tube containing slow-burning pyrotechnic composition that is sometimes used to ignite fireworks at outdoor fireworks displays.

3.3.31 Powder.

3.3.31.1 *Black Powder.* A low explosive consisting of an intimate mixture of potassium or sodium nitrate, charcoal, and sulfur. [**1126,** 2026]

3.3.31.2 *Salute Powder.* A pyrotechnic composition that makes an explosive sound when ignited and constitutes the sole pyrotechnic effect of a salute.

3.3.32* Pyrotechnic Material (Pyrotechnic Special Effects Material). A chemical mixture used in the entertainment industry to produce visible or audible effects by combustion, deflagration, or detonation. [**1124,** 2026]

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3.3.33* Pyrotechnic Professional. A person who has demonstrated proficiency and knowledge of applicable NFPA fireworks display code(s) via documented training and experience in the use of fireworks, pyrotechnic special effects materials, or professional-use-only products.

3.3.34 Pyrotechnic Special Effect. A special effect created through the use of pyrotechnic materials and devices. [**1126,** 2026]

3.3.35 Pyrotechnics. Controlled exothermic chemical reactions that are timed to create the effects of heat, gas, sound, dispersion of aerosols, emission of visible electromagnetic radiation, or a combination of these effects to provide the maximum effect from the least volume. [**1124,** 2026]

3.3.36 Ready Box. A sturdy container for storage of fireworks devices to be reloaded at the discharge site of a display.

3.3.37* Ready Box Tender. An assistant who controls and dispenses the contents of ready boxes during a fireworks display.

3.3.38 Roman Candle. A chain-fused firework that propels a series of aerial shell, comet, or mine effects into the air from a single tube.

3.3.39 Safety Cap. A tube, closed at one end, that is placed over the end of the fuse until the intended ignition to protect it from damage and accidental ignition.

3.3.40 Salute. Fireworks designed to produce an explosive sound as their primary effect.

3.3.40.1 ***Aerial Salute.*** A salute that functions as an aerial shell.

3.3.40.2 ***Ground Salute.*** A salute that functions from a stationary or secured position.

3.3.41 Shooter. A member of the fireworks display crew (either the operator or an assistant) who performs the actual ignition of the fireworks, either by manual or electrical means.

3.3.42 Site.

3.3.42.1 ***Discharge Site.*** The area immediately surrounding the location where fireworks and other devices are ignited for a display.

3.3.42.2 ***Display Site.*** The immediate area where a fireworks display is conducted, including the discharge site, the fallout area, and the required separation distance from mortars to spectator viewing areas, but not spectator viewing areas or vehicle parking areas.

3.3.43 Sponsor. The organization (person, group, or government agency) that arranges with a duly authorized fireworks supplier for its services in presenting a fireworks display or in providing fireworks for use in a display.

3.3.44 Spotter. A member of the fireworks display crew (either the operator or an assistant) who observes the firing and bursting of aerial shells and other display fireworks for the purpose of detecting proper mortar angling, noting the occurrence of duds, and observing for other potentially hazardous situations.

3.3.45 Trough. See 3.3.28, Mortar Trough.

Chapter 4 Requirements for Display Fireworks, Professional-Use-Only Products, and Equipment

4.1 Construction of Display Fireworks Aerial Shells.

4.1.1* Classification and Description. Aerial shells, mines, and comets shall be classified and described only in terms of the inside diameter of the mortar from which they are fired.

4.1.2* Construction. Aerial shells shall be constructed so that they fit into the appropriate size mortar and so that the lift charge and internal delay fuse propel the shell to the designed altitude before it functions.

4.1.3* Labeling of Display Fireworks, Aerial Shells, Mines, Comets, Candles, Cakes, and Professional-Use-Only Products.

4.1.3.1* Label Information. Each shell shall bear a label containing the following information:

(1) A description of the size of the shell
(2) A description of the type of shell
(3) A warning statement as shown in Figure 4.1.3.1
(4) The name and location of business of the manufacturer, importer, or distributor

4.1.3.2 Conspicuousness.

4.1.3.2.1 The statement "Warning: Dangerous Explosive" shall be printed in capital letters having a printed image of at least ⅛ in. (3.2 mm) and be underlined.

4.1.3.2.2 The remaining printed matter shall not be required to be printed in capital letters but shall have a printed image of at least ⅛ in. (3.2 mm).

4.1.3.2.3 The required statements shall be printed in a color contrasting sharply with the background and within a borderline.

4.1.3.2.4 The label shall be at least 9 in.^{2} (5810 mm^2), unless the size of the shell is too small, in which case the label shall be permitted to be reduced to a size no smaller than necessary.

4.1.4 Labeling of Professional-Use-Only Products. Each professional-use-only product shall meet the labeling requirements of NFPA 1126.

4.1.5 Fuses.

4.1.5.1 The fuse for manually fired individual aerial shells that use a quick match fuse to ignite the lift charge shall be long enough to allow not less than 6 in. (152 mm) of fuse to protrude after the shell has been inserted into the mortar.

4.1.5.2 Only the ignition leader of manually fired chain-fused aerial shells shall be required to be long enough to allow not less than 6 in. (152 mm) of fuse to protrude from the mortar.

4.1.5.3 Shells that are to be fired electrically shall not be required to have a quick match fuse.

WARNING: DANGEROUS EXPLOSIVE
IF FOUND, DO NOT HANDLE —
CONTACT LOCAL FIRE OR
POLICE DEPARTMENT.

FIGURE 4.1.3.1 Warning Statement.

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4.1.6 Time Delay.

4.1.6.1 The time delay from ignition of the tip of a manually fired aerial shell's fuse and the lifting of the aerial shell shall be designed to be not less than 2 seconds and not more than 6 seconds.

4.1.6.2 For electrically ignited aerial shells, no delay period shall be required.

4.1.7 Safety Cap. For manually fired shells, a safety cap shall be installed over the exposed end of the fuse.

4.1.7.1 The safety cap shall be a different color from that of the fuse and installed so that the fuse is not damaged.

4.1.7.2 Fuses of electrically fired shells shall not require a safety cap, provided there is no exposed pyrotechnic composition.

4.1.8 Salute Shell Limits.

4.1.8.1 Single-break aerial salute shells shall be limited to a maximum size of 5 in. (127 mm) in diameter and length.

4.1.8.2 Minimum standards for use of single-break aerial salute shells shall include the following:

(1) Nonmetal mortars shall be used.
(2) Individual mortars used for salutes more than 3 in. (76 mm) in diameter and length shall be individually supported and separated from other loaded mortars and other firework devices by at least 10 times the inside diameter of the largest mortar.
(3) Individual salutes more than 3 in. (76 mm) in diameter and length shall be permitted to be fired from racks, provided that only one mortar in the rack is used or unless the distance between loaded mortars in the rack meets the requirements of 4.1.8.2(2).
(4) Remote ignition or use of an added 5-second minimum delay fuse extension shall be used.
(5) Salute shells shall be preloaded into mortars.

4.1.8.3 Salutes more than 3 in. (76 mm) in diameter or length shall be permitted to be used only by the following:

(1) Licensed operators or designated agents of licensed companies
(2) Displays under the direct control of a licensed professional fireworks display company

4.1.8.4 Multiple-break shells with salutes and shells consisting of multiple-salute inserts or components shall be permitted, provided that the following requirements are met:

(1) Final or "bottom" shots (salutes) on multiple-break shells shall not exceed the criteria for single-break salutes.
(2) Aerial shells containing multiple salutes shall consist of component salutes not exceeding 3 in. (76 mm) and 3 oz (85 g) individually.
(3) Requirements for use and operator restrictions described for single-break salutes shall apply, except that multiple-break shells shall be permitted to be fired from steel mortars buried in the ground, troughs, or drums.

4.1.8.5 Ground salutes shall conform to the following specifications:

(1) Ground salutes shall not exceed 3 in. (76 mm) in diameter and length.
(2) The maximum quantity of salute powder in ground salutes shall not exceed 2.5 oz (71 g).
(3) Ground salutes shall be constructed of paper or other equivalent materials and shall not be constructed of metal or brittle plastic.

4.2 Storage and Transportation of Fireworks.

4.2.1* General. Any storage, handling, assembly, testing, or transportation of fireworks and pyrotechnic articles intended for outdoor display prior to their delivery to the display site or from the display site to the supplier shall be in accordance with the following:

(1) NFPA 1124
(2) 18 USC 40, "Importation, Manufacture, Distribution and Storage of Explosive Materials," and 27 CFR 555, "Commerce in Explosives"
(3) 49 CFR 171–180, "Hazardous Materials Regulations"

4.2.2 Preparation of Fireworks.

4.2.2.1 Fireworks and pyrotechnic articles shall be kept in their sealed shipping cartons until they are prepared, loaded, or set up for display.

4.2.2.2* Preparation area(s) for display fireworks shall be secured from public access by at least 100 ft (30 m).

4.2.2.3 Preparation area(s) shall have only authorized personnel in them at any time display fireworks are being prepared.

4.2.2.4* All fireworks shall be handled carefully while being unloaded from the delivery vehicle, prepared, loaded, or set up.

4.2.2.5* The assembly, minor repair, installation of fuses and electric matches, and similar activities shall be permitted to be performed in a preparation area and not be considered manufacturing.

4.2.2.6 All electric matches that are attached to display fireworks shall have a shroud protecting the match head.

4.2.2.7 The cutting of fuses, including quick matches, shall be prohibited when an electric match is known to be present in the fuses or quick matches being cut.

4.2.3 Inspection.

4.2.3.1 Shells shall be inspected by the operator or assistants following their delivery to the display site at any time prior to the shells being loaded into their mortars or into ready boxes.

4.2.3.2 Any shells having tears, leaks, broken fuses, or signs of having been wet shall be set aside for review by the operator.

4.2.3.3 If the operator determines that any aerial shells cannot be repaired as set forth in 4.2.3.6, those aerial shells shall be handled as follows:

(1) They shall not be fired.
(2) After the display, such shells shall be either returned to the supplier or disposed of in accordance with the supplier's instructions.

4.2.3.4 At the display site, assembly or repair of fireworks shall not be performed within 50 ft (15.2 m) of any location where bulk fireworks, assemblages of fireworks, or boxes of display fireworks have been temporarily placed during or pending the setup of the display.

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4.2.3.5 Assembly of fireworks at the display site shall be limited to ground display pieces from finished fireworks or pyrotechnic devices and the attachment of black matches, electric matches, or other ignition sources to fireworks and pyrotechnic devices.

4.2.3.6 Repair of fireworks and pyrotechnic devices at the display site shall be limited to repairs that do not require disassembly of the device.

4.2.4 Ready Boxes. A ready box shall be a portable, weather-resistant, and fire-resistive container that protects contents from burning debris with a self-closing cover or equivalent means of closure.

4.2.4.1 Tarpaulins shall not be used as ready boxes.

4.2.4.2 Manually fired shells used to reload mortars shall be stored in ready boxes and shall be separated according to size and designation as salutes.

4.2.4.3* During the performance of an outdoor fireworks display, ready boxes shall be located at a distance not less than 30 ft (9 m) upwind from the mortar placements.

4.2.4.4 If the wind shifts during a display, the ready boxes shall be relocated to be not less than 30 ft (9 m) upwind from the mortar placements, while maintaining the separation distance required in 5.1.3.4.3.

4.3 Installation of Mortars.

4.3.1* Inspection.

4.3.1.1 Mortars shall be inspected prior to placement.

4.3.1.2 Defective mortars shall not be used.

4.3.2* Mortars shall be positioned and spaced so that shells are propelled over the fallout area and to afford maximum protection to the shooter and loader. *(See also Section 5.2.)*

4.3.3* Where mortars are to be reloaded during a display, the following procedures shall be followed:

(1) Mortars of various sizes shall not be intermixed.
(2) Mortars of the same size shall be placed in groups, and the groups shall be separated from one another.

4.3.4 Plastic strip ties ("zip ties") shall not be used to secure or stabilize individual mortars or roman candles 2.5 in. (64 mm) in diameter or greater.

4.3.5 Mortar Reloading.

4.3.5.1 Unless the requirements of 4.3.5.2 are met, any type of mortar 6 in. (152 mm) in diameter or less shall be permitted to be reloaded and used up to seven times during a performance.

4.3.5.2 The requirements of 4.3.5.1 shall not apply to steel mortars, which require no limit to the number of times a steel mortar 6 in. (152 mm) or less is permitted to be reloaded.

4.3.6* Mortars shall be positioned to afford protection to the spectators and display personnel.

4.3.7 Mortars shall be inspected before the first shells are loaded, to ensure that no water or debris has accumulated in the bottom of the mortar.

4.3.8* Mortars shall be of sufficient strength and durability to launch safely the aerial shells loaded into them.

4.3.8.1* Paper, high-density polyethylene (HDPE), and fiberglass mortars shall be permitted to be used.

4.3.8.2 Metal mortars shall be permitted to be either seamed or seamless.

4.3.8.3 Where seamed mortars are used, mortars shall be placed so that all seams face either right or left when the line of mortars is viewed.

4.3.8.4 Cast iron, stovepipe, corrugated culvert, clay, bamboo, and wood shall not be used to make mortars.

4.3.9 Single-break salute shells shall be fired from nonmetallic mortars.

4.3.10* Mortars shall be of sufficient length to allow aerial shells to be propelled to the height at which the aerial shells were designed to burst.

4.4 Installation of Buried Mortars.

4.4.1* Mortars shall be buried to a depth of at least two-thirds of their length, either in the ground or in aboveground troughs or drums.

4.4.2 Drums used to secure individual mortars for remote ignition shall be filled to a depth that provides a stable base to prevent the mortar from shifting during firing, but no less than half the required length of the mortar.

4.4.3 The mortars specified in 4.4.2 shall not be reloaded.

4.4.4 Where paper mortars are to be placed in damp ground or damp sand or are to be in the ground or sand for more than 12 hours prior to the display, they shall be placed inside a water-resistant bag or otherwise protected against moisture prior to placement in the ground or sand.

4.4.4.1 Wherever there is the likelihood of groundwater leaking into the mortar, the mortar shall be placed inside a water-resistant bag prior to placement in the ground.

4.4.4.2 Weather-resistant coverings shall be placed over the mouth of mortars wherever there is imminent danger of water collecting in the mortars.

4.4.5* Where buried mortars are to be fired more than once during a display, the mortars shall be placed to prevent them from being driven into the ground or re-angled when fired.

4.4.6* Unless the requirements of 4.4.6.1 are met, mortars that are buried in the ground, in troughs, or in drums shall be separated from adjacent mortars by a distance at least equal to the diameter of the mortar.

4.4.6.1 The requirements of 4.4.6 shall not apply where electrical ignition of unchained aerial shells 6 in. (152 mm) and less in diameter is used, in which case no separation of mortars is required.

4.4.6.2 Mortars in troughs or drums shall be positioned to afford the maximum protection to the shooter.

4.4.6.2.1 In all other cases, a separation distance of at least 2 in. (51 mm) or one-half the diameter of the mortar, whichever is greater, shall be required between the mortar and the wall of the trough or drum.

4.4.6.2.2 Where electrical ignition is used, all mortars placed in troughs or drums shall be spaced at least 2 in. (51 mm) from the wall of the trough or drum.

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4.4.7 Trough and Drum Placement.

4.4.7.1 If troughs and drums are used, they shall be filled with sand or soft dirt and, in all cases, shall be free of stones or other potentially dangerous debris.

4.4.7.2 Troughs shall be reinforced or braced in a minimum of two places on the sides at intervals not greater than every 4 ft (1.2 m).

4.5 Installation of Mortar Racks.

4.5.1* Single-break shells not exceeding 6 in. (152 mm) in diameter shall be permitted to be fired from securely positioned mortar racks.

4.5.1.1* A device constructed of two or three single-break, 3 in. (76 mm) spherical shells shall be permitted to be fired from aboveground mortar racks provided the mortar is strong enough to maintain form during the firing of the shell.

4.5.1.2* A device constructed of two single-break, 4 in. (102 mm) spherical shells shall be permitted to be fired from aboveground mortar racks.

4.5.2 Single-break shells greater than 8 in. (203 mm) in diameter and multiple-break shells shall not be fired from mortar racks other than as permitted in 4.5.1.1 and 4.5.1.2.

4.5.3 Single-break shells that are 7 in. (178 mm) or 8 in. (203 mm) in diameter that are fired from mortar racks shall meet the following conditions:

(1) The mortar is not metallic.
(2) Electrical or equivalent means of remote ignition is used to fire the shell.
(3) The shell is not chain fused to any other shells.

4.5.4 Mortar racks and bundles shall be constructed and installed to hold multiple mortars in position during normal functioning.

4.5.5 The number of racks in a group of racks shall not be limited as long as the racks are securely fastened and stable.

4.5.6 Mortar racks or bundles that are not inherently stable shall be secured or braced by means of stakes, legs, A-frames, side-boards, or equivalent means.

4.5.6.1 Plastic strip ties ("zip ties") shall not be used to secure or stabilize mortar racks.

4.5.7* Mortar racks shall be permitted to be constructed of metal, wood, or other materials as long as the system and methods employed in the use of the racks are designed to protect the technicians and the public from injury due to catastrophic malfunction.

4.6 Requirements for Chain Fusing. Wherever more than three shells are to be chain fused, additional measures shall be required to prevent adjacent mortars from being repositioned in the event that a shell explodes in a mortar, causing it to burst.

4.6.1* Mortars in Racks.

4.6.1.1* For mortars in racks, repositioning shall be prevented by using mortar racks that are designed to withstand a shell exploding in a mortar, which can cause the mortar to burst.

4.6.1.2 Where there is doubt concerning the strength of racks holding mortar containing chain-fused aerial fireworks, the separation distances from those racks to spectators shall be twice those listed in Table 5.1.3.1 for the largest mortar in the sequence.

4.6.2 Mortar Racks Containing Chain-Fused Aerial Fireworks Requirements.

4.6.2.1 Unless the requirements of 4.6.2.2 apply, mortar racks containing chain-fused aerial fireworks shall comply with the following:

(1) Racks containing mortars 3 in. (76 mm) or less in diameter shall be limited to a maximum of 15 mortars per unit.
(2) Racks containing mortars 4 in. (102 mm) in diameter shall be limited to a maximum of 12 mortars.
(3) Racks containing mortars 5 in. to 6 in. (127 mm to 152 mm) in diameter shall be limited to a maximum of 10 mortars.
(4) Racks shall not be used for mortars greater than 6 in. (152 mm) in diameter.

4.6.2.2* The requirements of 4.6.2.1 shall not apply to boxed finale or boxed display items as supplied by the manufacturer containing mortars 4 in. (102 mm) or less in diameter.

4.6.2.3 The number of racks in a group of racks shall not be limited as long as each individual rack in the group complies with 4.6.2.1 and the racks are securely fastened and stable.

4.6.3* All chain-fused aerial fireworks devices, including those not in mortar racks, such as roman candle batteries and multi-tube aerial items, shall be held and positioned using a system to prevent tipover or hazardous movement during operation.

4.6.3.1 Additional means of securing or stabilizing shall not be required if the fireworks device is stable by means of an adequate base to height ratio or inherent weight while functioning.

4.6.4* The system and methods employed in the use of chain-fused aerial fireworks devices, including those not in mortar racks, such as roman candle batteries and multi-tube aerial items, shall be designed to protect the technicians and the public from injury resulting from catastrophic malfunction.

4.6.5 Staple guns shall not be permitted to be used to secure quick match that is connected to aerial shells, mines, or comets.

4.6.6 Mortars shall not be permitted to be reloaded with chain-fused aerial shells.

4.7 Trailer Firing.

4.7.1 General. This section shall address the use of trailers as firing platforms for mortars, mortar racks, or other pyrotechnic devices.

4.7.2 Mortars mounted on trailers shall not be reloaded during a display.

4.7.3 Mortars, mortar racks, and other pyrotechnic devices fired from trailers shall only be ignited electronically in accordance with Chapter 9.

4.7.3.1 Hand firing shall only be allowed from the trailer if the setup meets the requirements of Sections 7.3 and 7.6.

4.7.3.2 If there are no personnel on the trailer during the actual firing of the display, the requirements of Section 7.3, 7.6.1(3), 7.6.1(4), and 7.6.1(5) shall not apply.

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4.7.4 Mortars shall be made of materials that comply with this Code.

4.7.5 Trailers shall be secured and stabilized at the discharge site and disconnected from the tow vehicle prior to firing.

4.7.5.1* Trailers shall be stabilized to minimize movement in any direction during firing.

4.7.5.2 The deck of the trailer shall be constructed strong enough to withstand the repeated discharge of display fireworks and other pyrotechnic devices on its surface.

4.7.5.3 Trailers that are used shall be maintained in a roadworthy condition in accordance with all local, state, and federal regulations when the trailer is intended to travel on a public road or highway.

4.7.6 All mortars, mortar racks, or other pyrotechnic devices shall be secured in a manner that prevents any repositioning during the transportation and firing.

Chapter 5 Display Site Selection

5.1 General. The intent of this chapter shall be to provide requirements for clearances upon which the AHJ bases its approval of an outdoor fireworks display site.

5.1.1 AHJ Discretion.

5.1.1.1 Where added safety precautions have been taken, or particularly favorable conditions exist, the AHJ shall be permitted to decrease the required separation distances as it deems appropriate upon demonstration that the hazard has been reduced or the risk has been protected.

5.1.1.2 Where unusual or safety-threatening conditions exist, the AHJ shall be permitted to increase the required separation distances as it deems necessary.

5.1.2 Site Plan.

5.1.2.1 A site plan shall be submitted to the AHJ within a time period required by the AHJ prior to the display.

5.1.2.2* The site plan shall include the dimensions of the display site and location of discharge site(s), spectator viewing area(s), parking area(s), fallout area(s), and the associated separation distances.

5.1.2.2.1 For display sites where fireworks are to be discharged from an elevation greater than 25 ft (7.5 m) above ground level *(see 5.2.1.2)*, the elevation of the firing site(s) shall be included in the site plan.

5.1.2.2.2 For display sites where fireworks are to be discharged at angles for aesthetic purposes *(see 5.2.1.4.4)*, the location of the point(s) of discharge, the direction(s) of firing, and the firing tilt angle(s) shall be included in the site plan.

5.1.2.3 After review of the site plan, the AHJ shall inspect the area depicted on the site plan. *(See Annex B for additional information.)*

5.1.2.4 When trenches or holes are dug into the ground in order to place mortars, the operator shall consult with the sponsor and the AHJ in order to locate any buried utility lines in the discharge site.

5.1.2.5* Multi-Sized Device Spacing.

5.1.2.5.1 Within each discharge site, each fireworks device shall be located so as to provide at least the minimum separation distances from spectators as required for that device in 5.1.3 and Table 5.1.3.1.

5.1.2.5.2 Within each discharge site, smaller devices shall be permitted to be placed at distances closer to spectators than larger devices, as long as the smaller devices also provide at least the minimum separation distances from spectators as required for those devices in 5.1.3 consistent with the distances in Table 5.1.3.1.

5.1.3* Minimum Site Size Requirements. The site for the outdoor land or water display shall have a radius at least as great as specified for those items in the display with the greatest required radius.

5.1.3.1 For aerial shells, the minimum required radius of the display site shall be 70 ft/in. (22 m/25 mm) of the internal mortar diameter of the largest aerial shell to be fired, as shown in Table 5.1.3.1.

5.1.3.2 For non-splitting or non-bursting comets and mines containing only stars or non-splitting or non-bursting comets, the minimum required radius of the display site shall be 35 ft/in. (11 m/25 mm) of the internal mortar diameter of the largest comet or mine to be fired, one-half that shown in Table 5.1.3.1.

5.1.3.3 Minimum Radius for Chain-Fused Aerial Shells, Comets, and Mines.

5.1.3.3.1 For chain-fused aerial shells, comets, and mines to be fired from mortars, racks, or other holders that are sufficiently strong to prevent their being repositioned in the event of an explosive malfunction of the aerial shells, comets, or mines, the minimum required radius of the display site shall be the same as that required in 5.1.3.1 and 5.1.3.2. *(See also Section 4.6.)*

5.1.3.3.2 For chain-fused aerial shells, comets, and mines to be fired from mortars, racks, or other holders that are not sufficiently strong to prevent their being repositioned in the event of an explosive malfunction of the aerial shells, comets, or mines, the minimum required separation distance shall be double that required in 5.1.3.1 and 5.1.3.2.

5.1.3.4 Roman Candles and Cakes.

5.1.3.4.1 For roman candles and cakes, the minimum required radius of the display site shall be that specified for chain-fused aerial shells, comets, or mines, depending on whether they produce aerial shell, comet, or mine effects.

5.1.3.4.2 For roman candles and cakes producing both aerial shell and comet or mine effects, the minimum required radius of the display site shall be that for aerial shells.

5.1.3.4.3 During the firing of the display, cakes shall be located a minimum of 100 ft (30 m) from any ready box and mortars to be reloaded.

5.1.3.5 Ground Display Pieces.

5.1.3.5.1* For ground display pieces of low hazard potential, the minimum radius of the display site shall be 75 ft (23 m).

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Table 5.1.3.1 Distances for Outdoor Aerial Shell Display Sites: Minimum Separation Distances from Mortars to Spectators for Land or Water Displays

Mortar Size[a]		Minimum Secured Diameter of Site[b]		Vertical Mortars[c]		Angled Mortars 1/3 Offset[d]		Mortars to Special Hazards[e]	
in.	mm	ft	m	ft	m	ft	m	ft	m
≤1	25	150	46	75	23	75	23	150	46
1.5	38	210	64	105	32	75	23	210	64
2	50	280	85	140	43	95	29	280	85
2.5	63	350	107	175	54	115	35	350	107
3	76	420	128	210	64	140	43	420	128
4	102	560	171	280	85	190	58	560	171
5	127	700	213	350	107	230	70	700	213
6	152	840	256	420	128	280	85	840	256
7	178	980	299	490	149	320	98	980	299
8	203	1120	341	560	171	370	113	1120	341
10	254	1400	427	700	213	460	140	1400	427
12	305	1680	512	840	256	560	171	1680	512

[a]See 4.1.1. Note that the discharge of fireworks using mortars >12 in. (>305 mm) in size requires the approval of the AHJ.
[b]See 5.1.3.
[c]See 5.2.1.4.
[d]See 5.2.1.4. Note that for mortars angled away from the main spectator area, the minimum secured diameter of the display site does not change. Only the location of the mortars within the secured area changes when the mortars are angled away from the main spectator area.
[e]See 5.1.4. Note that this is only the distance to the special hazards. The minimum secured diameter of the display site does not change.

5.1.3.5.2* For ground display pieces with greater hazard potential, the minimum radius of the display site shall be 125 ft (38 m).

5.1.3.6 Equipment, including mortars, used as holders to support smaller devices such as roman candles, pre-loaded mines, and pre-loaded comets shall not be used to determine the radius or area of the display site or the separation distances.

5.1.3.7* Flammable Liquid Fireball Effects.

5.1.3.7.1 For effects using black powder or a black powder equivalent as a propellant and those using gasoline, alcohol, or other flammable liquids for fireball effects, whether discharged from mortars or from other devices, the separation distances provided in Table 5.1.3.7.1 shall apply.

5.1.3.7.2 When multiple devices are clustered together with distances of less than 10 ft between the individual effect devices to create a single fireball effect, the aggregate capacity of those devices shall be taken to determine the separation distance for the combined effects.

5.1.3.7.3 When multiple devices are lined up for a wall of fire effect and where each device is separated by a minimum of 10 times the inside diameter of the individual device, the audience separation distance shall be determined by the individual capacity of each device.

5.1.3.7.4 When prevailing winds are oriented toward the audience, a 50 percent increase in audience separation distance shall be required.

5.1.3.7.5 Flammable liquid fireball effects shall be separated from fireworks and other devices as follows:

Table 5.1.3.7.1 Distances for Flammable Effects: Minimum Separation Distances from Mortars to Spectators for Land or Water Displays

Device Capacity (gal)	Device Capacity (L)	Audience Separation Distance (ft)	Audience Separation Distance (m)
≤5	≤19	75	23
>5–25	>19–95	150	46
>25–50	>95–189	200	61
>50–100	>189–379	250	76
>100–200	>379–757	300	91
>200–400	>757–1514	350	107
>400	>1514	600	183

(1) By a distance of at least 10 ft (3 m) for single flammable liquid fireball effects
(2) By a distance of at least 25 ft (7.6 m) for clusters of multiple flammable liquid fireball effects

5.1.3.7.6 The requirements of 5.1.3.7.5 shall not apply to fireworks and devices fired in conjunction with flammable liquid fireball effects.

5.1.3.8 Solid Fuel Fireball Effects.

5.1.3.8.1* For effects using black powder or a black powder equivalent as a propellant and those using powdered solids for fireball effects, whether discharged from mortars or other devices, the separation distance to the audience shall be the lesser

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of the distance required for the device as calculated by the volume of the device per 5.1.3.8.1.1 or either of the following:

(1) For round devices, the separation distance shall be 12.5 ft (3.81 m) per 1 in. (25 mm) of the internal diameter of the largest device to be fired.
(2) For rectangular devices, the separation distance shall be 12.5 ft (3.81 m) per 1 in. (25 mm) of the largest dimension (width or length) of the largest device to be fired.

5.1.3.8.1.1 Volume-based audience separation distances shall be calculated per Table 5.1.3.8.1.1.

5.1.3.8.1.2 If multiple devices are separated by less than 10 ft (3 m) to create a single fireball effect, the combined volume of all devices and not device size or diameter shall determine the audience separation distance.

5.1.3.8.2* Solid fuel fireball effects shall not contain any type of pyrotechnic insert.

5.1.3.8.3 Devices for firing solid fuel fireball effects shall be one of the following:

(1) Display fireworks mortars
(2) Plastic containers, provided all the parts other than the containment portion are removed
(3) Cardboard containers
(4) Metal containers that are able to withstand the forces of the effect without fragmentation

5.1.3.8.4 When prevailing winds are oriented toward the audience, a 20 percent increase in audience separation distance shall be required.

5.1.3.8.5 Solid fuel fireball effects shall be assembled in their respective firing locations and not moved or transported after assembly.

5.1.3.8.6* Solid fuel fireball effect devices using black powder or equivalent propellants that are used in a display with projectile or other firework devices shall be protected from premature ignition caused by debris or other components of the projectile fireworks by means of a plastic, foil, or similar covering.

5.1.4 Other Site Requirements.

5.1.4.1* Distances from the point of discharge of any firework to a health care or detention and correctional facility shall be at least twice the distances specified in 5.1.3.

Table 5.1.3.8.1.1 Volume-Based Audience Separation Distances

Volume (gal)	Volume (L)	Separation Distance (ft)	Separation Distance (m)
<1	<4	50	15
1–4	4–15	75	23
>4–10	>15–38	150	46
>10–25	>38–95	200	61
>25–100	>95–379	250	76
>100–200	>379–757	300	91
>200–400	>757–1514	350	107
>400	>1514	600	183

5.1.4.2 The requirements of 5.1.4.1 shall not apply where approved by the AHJ and the health care or detention and correctional facility.

5.1.4.3* The distance between the discharge site and bulk storage areas of materials that have a flammability, explosive, or toxic hazard shall be twice that required by 5.1.3.

5.1.4.4 The fuel tanks on vehicles or other motorized equipment located in the display site shall not be considered bulk storage.

5.1.4.5 No spectators or spectator parking areas shall be located within the display site.

5.1.4.6 Dwellings, buildings, and structures shall be permitted to be located within the display site with the approval of the AHJ and the owner of the dwelling, building, or structure, provided that the dwelling, building, or structure is unoccupied during the display, or if the structure provides protection for the occupants through noncombustible or fire-resistant construction.

5.1.4.7 The area selected for the discharge of aerial shells shall be located so that the trajectory of the shells shall not come within 25 ft (7.6 m) of any overhead object.

5.1.5 Fallout Area.

5.1.5.1* The fallout area shall be an open area.

5.1.5.2 Spectators, unauthorized vehicles, watercraft, or readily combustible materials shall not be located within the fallout area during the display.

5.1.6 Fire protection and other emergency response personnel and their vehicles shall remain at or beyond the perimeter of the display site during the actual firing of the display.

5.2 Minimum Spectator Separation Distance Requirements.

5.2.1 The minimum spectator separation distance from the point of discharge of each firework shall be at least as great as those specified in this section.

5.2.1.1* For aerial shells, comets, mines, roman candles, and cakes that are discharged vertically from firing positions elevated 25 ft (7.6 m) or less above ground level, the minimum required spectator separation distance shall be the same as the minimum required radius specified in 5.1.3, including Table 5.1.3.1.

5.2.1.2 For aerial shells, comets, mines, roman candles, and cakes that are discharged vertically from firing positions elevated more than 25 ft (7.6 m) above ground level, the minimum required spectator separation distance required by 5.2.1.1 shall be increased by 25 ft (7.6 m) and an additional 25 ft (7.6 m) for each 100 ft (30 m) of elevation.

5.2.1.3 For ground display pieces and mines containing only stars or non-splitting or non-bursting comets fired vertically from any elevation, the minimum required spectator separation distance from the point of discharge shall be the same as the minimum display site radius specified in 5.1.3.

5.2.1.4 Angling of Mortars.

5.2.1.4.1* Aerial shells, comets, mines, roman candles, and cakes shall be permitted to be angled as needed to adjust for the effects of wind on the fallout of dud aerial shells.

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5.2.1.4.2* Aerial shells, comets, mines, roman candles, and cakes shall be permitted to be angled if the shells or components are projected away from the main spectator area and the location of the mortars are offset as specified in Table 5.1.3.1.

5.2.1.4.3* If the offset provided in Table 5.1.3.1 is followed, the mortars or tubes shall be angled so that any dud shells or components fall at a point approximately equal to the offset of the mortars or tubes from the otherwise required discharge point, but in the opposite direction.

5.2.1.4.4 Aerial shells, comets, mines, roman candles, and cakes shall be permitted to be angled for aesthetic effect if the spectator separation distance specified in 5.2.1 is correspondingly increased in the direction of the mortar tilt angle.

5.3 Tents.

5.3.1 Tents shall be permitted in the display site during the display as approved by the owner, operator, and AHJ.

5.3.2 Tents within the display site shall not be occupied during the display.

Chapter 6 Floating Vessels and Floating Platforms

6.1 General.

6.1.1 The intent of this chapter shall be to provide guidance for the display of fireworks from floating vessels and floating platforms.

6.1.2 Floating vessels and floating platforms shall be permitted to be manned or unmanned, provided that the pyrotechnic crew remains in control of the site and firing of the display.

6.1.3 Floating vessels and floating platforms shall be held in control at all times, whether self-propelled, controlled by another vessel, or secured by mooring or anchoring.

6.2 Construction.

6.2.1* Floating vessels and floating platforms shall be of sufficient strength and stability to safely allow the firing of the display.

6.2.2 The types of fireworks and placement of the fireworks launch tubes and accompanying equipment shall be such that, when fired, the stability of the site structures and seaworthiness of the floating vessels or platforms shall not be jeopardized.

6.2.3 Floating vessels and floating platforms that are manned during electrical firing shall have a safety shelter meeting the following requirements:

(1) It shall be of sufficient size to accommodate all personnel present during the actual firing of the display.
(2) It shall have a minimum of three sides and a roof.
(3) It shall have walls and a roof constructed of at least ¾ in. (19 mm) plywood or equivalent material.

6.3 Platform Sizing Requirements.

6.3.1* Criteria for Sizing. The minimum size for the floating vessel or floating platform for electrically fired programs that are manned shall be based on the area for the setup of the display plus the area for the safety shelter.

6.3.1.1 Minimum Barge Area. The minimum barge area specifications shall be defined by the following formula:

[6.3.1.1]

$$\text{Minimum barge area} = M + C + G$$

where:
M = area needed for mortars (ft^2)
C = area needed for cakes and multi-tube devices (ft^2)
G = area needed for ground displays (ft^2)

6.3.1.1.1 The area needed for mortars and mortars in racks (M) shall be calculated according to the following formula:

[6.3.1.1.1a]

$$M = \sum \frac{M_n \times D_n}{2}$$

where:
M = area needed for mortars and mortars in racks (ft^2)
M_n = number of each mortar size from 1 to n
D_n = inside diameter of each size mortar (in.)

[6.3.1.1.1b]

$$M = \sum \frac{M_n \times D_n}{547}$$

where:
M = area needed for mortars and mortars in racks (m^2)
M_n = number of each mortar size from 1 to n
D_n = inside diameter of each size mortar (mm)

6.3.1.1.2 The area needed for cakes and multi-tube devices (C) up to 3 in. (76 mm) shall be calculated using the following formula:

[6.3.1.1.2]

$$C = \sum 2 \times C_n \times F_n$$

where:
C = area needed for cakes and multi-tube devices up to 3 in. (76 mm) (ft^2)
C_n = number of each cake and multi-tube size from 1 to n
F_n = footprint for each size cake and multi-tube device (ft^2)

6.3.1.1.3 The area needed for ground display items (G) shall be calculated using the following formula:

[6.3.1.1.3]

$$G = \sum G_n \times A_n$$

where:
G = area needed for ground display items (ft^2)
G_n = number of each type of ground item from 1 to n
A_n = footprint occupied by each type of ground display item (ft^2)

6.3.1.2 Safety Shelter Area Requirements.

6.3.1.2.1 The minimum separation distance between mortars and the safety shelter shall be as follows:

(1) 2 ft/in. (0.6 m/25 mm) of the shell diameter of mortars up to 6 in. (152 mm) in diameter

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(2) 4 ft/in. (1.2 m/25 mm) of the shell diameter of mortars larger than 6 in. (152 mm) in diameter

6.3.1.2.2 If the safety shelter is constructed of material stronger than that required by 6.2.3(3), the separation distance between mortars and the shelter shall be permitted to be reduced.

6.3.2 Egress Requirements.

6.3.2.1 A minimum of two separate egress paths shall be provided at all times.

6.3.2.2 Only one egress path from protective barricades or safety shelters shall be required.

6.3.2.3 Egress paths shall be unobstructed and free of impediments.

6.3.2.4* Temporary Structures and Barriers. Other than the shelter required by 6.2.3 or 6.4.1, temporary structures and barriers that impede egress or access to the barge or floating platform that have not been determined by the display operator to be necessary for the safe setup and operation of the display shall not be placed or constructed on or near the barge or floating platform used for the display.

6.3.3* Floating Platforms. Floating platforms constructed of wood or other combustible material shall be permitted to be used as a fireworks launch vessel.

6.4 Operations.

6.4.1 Manual firing of displays shall be permitted on floating vessels and floating platforms under the following conditions:

(1) All shells shall be preloaded into mortars prior to the display.
(2) Shells shall be limited to single-break and shall not exceed 6 in. (152 mm) in diameter.
(3) The minimum size of the floating vessel or floating platform shall be twice that required for an electrically fired display as specified in 6.3.1.
(4) A protective barrier(s) meeting the strength requirements of ¾ in. (19 mm) plywood or equivalent shall be provided.
(5) During the display, all personnel other than the shooter(s) and operator shall be behind the barrier(s) specified in 6.4.1(4).
(6) Electrical firing on the same vessel or platform where manual firing is used shall be in accordance with 9.1.3.

6.4.2 Shells shall be loaded into mortars and in place prior to the start of a display.

6.4.3 No reloading of any material during the display shall be permitted.

6.4.4 At an electrically fired display, all personnel, other than spotters and fire watch, shall be in safety shelters.

6.4.5 During the display, spotters and fire watch on a floating platform or a floating vessel shall be behind protective barriers with a minimum wall construction of ¾ in. (19 mm) plywood or equivalent material.

6.4.6 A US Coast Guard–approved personal flotation device (PFD) shall be provided and available for each person on a display launched from floating vessels and floating platforms.

6.4.6.1 PFDs shall be worn as designed any time the vessel is not moored at the dock.

6.4.6.2 PFDs shall have a visual location device.

6.4.7 A watercraft ready and capable of providing rapid emergency response shall be present during the display.

6.4.8* The positions of the mortars on floating vessels and floating platforms from which fireworks are launched shall comply with minimum safety distance requirements as outlined in Table 5.1.3.1.

6.4.9* Fireworks crew members on barges and floating platforms shall not, without the direction of the operator, engage in activities that distract from or interfere with the safe set up, firing, clearing, and striking of the fireworks display, or the continuous monitoring for potential hazards.

6.5* Communications. An approved means of communication shall be aboard manned vessels and platforms from which fireworks are being discharged.

6.6* Personnel. During the display, only necessary personnel shall be aboard any floating vessel or floating platform.

6.7 Combustible Material.

6.7.1* Floating vessels and floating platforms shall be free of all nonessential flammable or combustible materials.

6.7.2 Tank vessels used as floating platforms shall be certified as gas free in accordance with NFPA 306.

6.7.3 Portable power generation equipment, motorized vehicles, and material-handling equipment deemed necessary for the performance of the display shall be permitted.

6.8 Marine Preparation Area Separation.

6.8.1 Dwellings, buildings, structures, and marine craft shall be permitted to be located within 100 ft (30 m) of the preparation area with the approval of the AHJ and the owner of the dwelling, building, structure, or marine craft, provided that either of the following conditions is met:

(1) The dwelling, building, structure, or marine craft is unoccupied during the loading of the floating platform.
(2) The dwelling, building, structure, or marine craft provides protection for the occupants through noncombustible or fire-resistant construction.

6.8.2 Unauthorized marine craft shall be separated from floating vessels or platforms by a minimum distance of 25 ft (7.6 m) during loading of fireworks.

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Chapter 7 Rooftops, Other Structures, and Other Limited Egress Locations

7.1 General Conditions.

7.1.1 The intent of this chapter is to provide additional guidance for the outdoor display of fireworks from rooftops, bridges, towers, stadiums, parking decks, other structures, and other limited egress locations.

7.1.2 Due to the unique elements of these types of displays, the operator shall have the knowledge and experience for the specialized nature of these locations.

7.1.3 Spectator separation distances for elevated firing positions, shall be as specified in Section 5.2.

7.2 Construction.

7.2.1* Rooftops, bridges, towers, parking decks, and any other structures used as discharge sites shall be of sufficient strength and stability to safely allow the firing of the display.

7.2.2 Rooftops, bridges, towers, parking decks, and any other structures used as discharge sites shall be approved by the AHJ and the owner (or his or her agent).

7.2.3 Other dwellings, buildings, and structures shall be permitted to be located within the display site, provided all the following requirements are met:

(1) Approval of the AHJ
(2) Approval of the owner of the dwelling, building, or structure
(3) Assurance that the dwelling, building, or structure is unoccupied during the display, or the occupants are protected by the dwelling, building, or structure or other means
(4) Notification to the responding local fire department if other than the AHJ

7.3 Size Requirements.

7.3.1 The minimum size of the area needed for a limited egress location shall be based upon the area for the setup of the display plus the safety area for the personnel.

7.3.2 The minimum specifications shall be defined by the following formula:

[7.3.2]

$$\text{Minimum limited egress location area} = M + C + G$$

where:
M = area needed for mortars (ft^2)
C = area needed for cakes and multi-tube devices (ft^2)
G = area needed for ground displays (ft^2)

7.3.2.1 The area needed for mortars and mortars in racks (M) shall be calculated according to the following formula:

[7.3.2.1a]

$$M = \sum \frac{M_n \times D_n}{2}$$

where:
M = area needed for mortars and mortars in racks (ft^2)
M_n = number of each mortar size from 1 to n
D_n = inside diameter of each size mortar (in.)

[7.3.2.1b]

$$M = \sum \frac{M_n \times D_n}{547}$$

where:
M = area needed for mortars and mortars in racks (m^2)
M_n = number of each mortar size from 1 to n
D_n = inside diameter of each size mortar (mm)

7.3.2.2 The area needed for cakes and multi-tube devices (C) up to 3 in. (76 mm) shall be calculated using the following formula:

[7.3.2.2]

$$C = \sum 2 \times C_n \times F_n$$

where:
C = area needed for cakes and multi-tube devices up to 3 in. (76 mm) (ft^2)
C_n = number of each cake and multi-tube size from 1 to n
F_n = footprint for each size cake and multi-tube device (ft^2)

7.3.2.3 The area needed for ground display items (G) shall be calculated using the following formula:

[7.3.2.3]

$$G = \sum G_n \times A_n$$

where:
G = area needed for ground display items (ft^2)
G_n = number of each ground item from 1 to n
A_n = footprint occupied by each ground display item (ft^2)

7.3.3 In the event personnel are present at the firing location during the firing of the display, an additional safety area shall be provided to accommodate those personnel.

7.3.3.1 This area shall be located according to the following:

(1) A minimum of 75 ft (23 m) from the closest aerial shell mortar
(2) A minimum of 15 ft (4.6 m) from the nearest pyrotechnic effect where some alternative means of protection is provided for the personnel *(see A.8.2.9.2.2)*

7.3.3.2 The provisions of 7.3.3 and 7.3.3.1 shall not be required where some alternative means of protection is provided for the personnel *(see A.8.2.9.2.2)*.

7.3.4 Where the requirements of 7.3.3 are not met for aerial shell mortars, a safety shelter shall be provided at the firing location.

7.3.4.1 The safety shelter shall meet the following specifications:

(1) Be of sufficient size to accommodate all personnel present during the actual firing of the display
(2) Have a minimum of three sides and a roof
(3) Have walls and a roof constructed of at least ¾ in. (19 mm) plywood or equivalent material

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7.3.4.2 Separation between aerial shell mortars and the safety shelter shall be 2 ft/in. (0.6 m/25 mm) of diameter of any mortars up to 6 in. (152 mm) in diameter.

7.3.4.3 For shells larger than 6 in. (152 mm) in diameter, the minimum separation distance between aerial shell mortars and the safety shelter shall be 4 ft/in. (1.2 m/25 mm) of shell diameter.

7.4 Egress Requirements.

7.4.1 During the firing of the display, an egress path shall be provided from any area where personnel are present in the discharge site.

7.4.2 Egress paths shall be unobstructed and free of impediments.

7.4.3 Egress paths shall be in a direction that does not pass through a discharge site.

7.5 Rooftops and Other Structures.

7.5.1 All openings in a rooftop or on the surface of any other structure shall be identified by the building owner or agent, venue manager, or maintenance personnel as to the function of the opening.

7.5.2 Any glass, openings, or fragile ornamentation in the display area shall be protected from damage caused by the display.

7.5.3 Intake Openings.

7.5.3.1 Intake openings for HVAC or ventilation in the proximate area of the firing site shall be covered to prevent any smoke or material from entering the building.

7.5.3.2 If the intake openings cannot be covered, the circulating system shall be disabled during the firing of the display.

7.5.4* Vent pipes for sewer vents shall be covered to prevent any flammable material from entering these openings during the display.

7.5.5 There shall be no overhead towers, antennas, or electric or communication lines within 25 ft (7.6 m) of the trajectory of an aerial shell.

7.5.6 The operator, the building owner or agent, and the AHJ shall determine if there are any requirements necessary to protect the surface of the roof or structure from any operation of the conduct of the display.

7.5.7 Security.

7.5.7.1 When the delivery of fireworks or other pyrotechnic materials is conducted in an area open to the public, the fireworks or pyrotechnic materials shall be protected from direct access by the public.

7.5.7.2 Any time the fireworks or pyrotechnic materials are on location, they shall not be left unattended or unsecured.

7.5.8 When required by the AHJ, the parking location of the vehicle containing the fireworks or the pyrotechnic materials and the path for their delivery shall be approved prior to the time they are delivered to the location.

7.6 Operations.

7.6.1 Manual firing of displays shall be permitted on rooftops, bridges, towers, stadiums, parking decks, other structures, and other limited egress locations under the following conditions:

(1) All shells shall be preloaded into mortars prior to the display.
(2) Shells shall be limited to single-break and shall not exceed 6 in. (152 mm) in diameter.
(3) The minimum size of the discharge site shall be twice that required for an electrically fired display, as specified in 7.3.1.
(4) A protective barrier(s) meeting the strength requirements of ¾ in. (19 mm) plywood or equivalent shall be provided.
(5) During the display, all personnel other than the shooter(s) and operator shall be behind the barrier(s) specified in 7.3.4.
(6) Electrical firing on the same discharge site where manual firing is used shall be in accordance with 9.1.3.

7.6.2 Loading.

7.6.2.1 Fireworks and pyrotechnic materials shall be loaded into mortars or in place prior to the start of a display.

7.6.2.2 There shall be no reloading of any fireworks and pyrotechnic materials during firing of the display.

7.6.3 Fireworks and pyrotechnic materials shall be fired only when the display site is in clear view of the pyrotechnic operator or an assistant who is in direct communication with the operator.

7.6.4 Spotters.

7.6.4.1 During the display, approved support personnel shall be positioned to visually observe the roofs of any structures within the fallout area.

7.6.4.2 The approved support personnel shall be in communication with the shooter and the fire service assigned to the display.

7.6.5 During the display, two-way voice communication shall be present on sites from which fireworks and other pyrotechnic materials are being discharged, with communication between each shooter, the operator, and life safety personnel.

7.7 Flammable and Combustible Materials.

7.7.1 Rooftops, other structures, and other limited egress locations shall be free of all nonessential flammable or combustible materials.

7.7.2 All flammable or combustible materials shall be protected or removed from the display site.

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Chapter 8 Operation of the Display

8.1 General Requirements. The sponsor of the display shall make provisions for fire protection for the display.

8.1.1* The sponsor shall consult with the AHJ, the local responding fire department (if different from the AHJ), and the operator to determine the level of fire protection required.

8.1.2* The following shall apply to crowd control:

(1) Monitors whose sole duty is the enforcement of crowd control shall be located around the display site and at other locations as determined by the sponsor.
(2) The AHJ and the operator shall approve the provisions for crowd control.

8.1.2.1 Monitors shall be positioned around the display site to prevent spectators or any other unauthorized persons from entering the discharge site.

8.1.2.2 Where required by the AHJ, approved delineators or barriers shall be used to aid in crowd control.

8.1.2.3 Portions of the display site, other than the discharge site(s), shall be permitted to be open to the public prior to the display as long as the provisions of 4.2.2.2 are maintained.

8.1.2.4 Unescorted public access to the discharge site shall not be permitted where pyrotechnic materials are present during the period before the display.

8.1.2.5 The discharge site shall be restricted throughout the display and until the discharge site has been inspected after the display.

8.1.3* The operator shall have primary responsibility for safety.

8.1.3.1* The operator alone shall be responsible for determining the number of assistants required and for ensuring that a sufficient number of assistants are available for the safe conduct of the fireworks display.

8.1.3.2 Only the operator, authorized assistants, and inspector(s) representing the AHJ shall be permitted in the display site while the display is in progress.

8.1.3.3 The operator shall be responsible for ensuring that all assistants are trained in the performance of their assigned tasks and that they are educated with regard to safety hazards.

8.1.3.4* During the firing of the display, all personnel in the discharge site shall wear the following:

(1) Head protection
(2) Eye protection
(3) Hearing protection
(4) Foot protection
(5) Cotton, wool, or similarly flame-resistant, long-sleeved, long-legged clothing

8.1.3.5 Personal protective equipment (PPE), as necessary, shall be worn by the operator and assistants during the setup and cleanup of the display.

8.1.4 Wherever, in the opinion of the AHJ or the operator, any hazardous condition exists, the fireworks display shall be stopped until the condition is corrected.

8.1.4.1 If, in the opinion of the AHJ or the operator, the lack of crowd control poses a hazard, the fireworks display shall be postponed or discontinued immediately until such time as the situation is corrected.

8.1.4.2* If high winds, precipitation, or other adverse weather conditions prevail or begin such that a hazard exists in the opinion of the operator or the AHJ, the fireworks display shall be postponed or discontinued until weather conditions improve.

8.1.4.3 One or more spotters shall watch the flight and behavior of aerial shells and other aerial fireworks to verify that they are functioning as intended.

8.1.4.3.1 If any unsafe condition is detected, such as hazardous debris falling into the audience, the spotter shall signal the shooter to cease firing until the unsafe condition is corrected.

8.1.4.3.2 The spotters shall be in direct communication with the shooter during the conduct of the display.

8.1.4.4 In the event of a condition arising that requires the entry of fire protection or other emergency response personnel into the fallout area or security perimeter, the display shall be halted until the situation is resolved and the area is once again clear.

8.1.5 Operators and assistants shall use only flashlights, electric lighting, or other nonincendive illumination such as chemiluminescent devices for illuminating the firing area and the ready box area.

8.1.6 Control of Ignition Sources.

8.1.6.1 Smoking materials, matches, lighters, or open flame devices shall not be permitted within 50 ft (15 m) of any area where fireworks or other pyrotechnic materials are present.

8.1.6.2 Devices such as fusees, portfires, and torches shall be permitted to be used to ignite fireworks.

8.1.7 Pyrotechnic materials used in the display shall be protected from adverse weather conditions.

8.1.8 Moisture-damaged pyrotechnic materials shall not be used.

8.1.9 Impairment.

8.1.9.1* No person shall be present in the discharge site with alcohol in his or her system or while under the influence of drugs that are not over-the-counter or prescription medications used in compliance with the manufacturer's or physician's written instructions.

8.1.9.2 No person shall be present in the discharge site while under the influence of over-the-counter or prescription medications that impair the judgment, mobility, or stability of the user to such a degree that he or she cannot understand and conform to the requirements of applicable laws, regulations, and standards governing the display.

8.2 Firing of Shells.

8.2.1* Shells shall be carried from the storage area to the discharge site only by the body of the shell and shall not be carried by their fuses.

8.2.2* Loading.

8.2.2.1 When being loaded into the mortars, shells shall be held by their fuses or lowering cords if provided and shall be lowered into the mortar.

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8.2.2.2 At no time shall any part of the body of the loader be over the mouth of the mortar.

8.2.3 Shells shall be checked for correct fit in their mortars prior to the display.

8.2.4* Shells shall be seated at the bottom of the mortar.

8.2.5 Incorrect Fit.

8.2.5.1 Shells shall not be forced into a mortar too small to accommodate them.

8.2.5.2 Shells that do not fit properly into the mortars shall not be fired and shall be disposed of in accordance with the procedure prescribed in 8.2.10.2.

8.2.6* Manually fired shells shall be ignited by lighting the tip of the fuse with a fusee, torch, portfire, or similar device.

8.2.6.1 The safety cap protecting the fuse shall be removed only by the shooter and only immediately before the shell is to be fired.

8.2.6.2 As soon as the fuse is ignited, the shooter shall turn and step away from the immediate proximity of the mortar area.

8.2.7 Under no circumstances shall a person place any body part over the mortar during the loading and firing of a display until mortars have been checked following the display for the absence of any shells.

8.2.8 The following safety requirements shall apply once an outdoor fireworks display has begun:

(1) The first shell fired shall be observed to determine whether the shell functions over the fallout area and whether any hazardous debris or unexploded shells land in the fallout area.
(2) The display shall be interrupted at any time, and the mortars shall be re-angled or repositioned as necessary, for safety during an outdoor fireworks display.

8.2.9 Large-Diameter Shells.

8.2.9.1 Loading Requirements. Aerial shells greater than 6 in. (152 mm) in diameter shall be preloaded into mortars prior to the beginning of the display.

8.2.9.2 Firing Methods.

8.2.9.2.1 Unless the requirements of 8.2.9.2.2 are met, all aerial shells greater than 6 in. (152 mm) in diameter shall be fired using electrical ignition *(see Chapter 9)* or other means of remote ignition that places the shooter and assistants at least 75 ft (23 m) away from the mortar or behind a sturdy barricade at the time of ignition of the lift charge.

8.2.9.2.2* Shells that are nominal 7 in. (178 mm) or 8 in. (203 mm) in diameter shall not be subject to the requirements of 8.2.9.2.1, but shall be permitted to be ignited manually, provided that the mortars are buried at least three-quarters of their length into the ground and the shooter has been provided with alternative means of protection.

8.2.10* Unfired Shells. In the event that a shell fails to ignite in the mortar, the mortar shall be marked to indicate the presence of an unfired shell, and the mortar shall not be reloaded or reused while the misfired shell remains a hazard.

8.2.10.1 Handling Procedures.

8.2.10.1.1 Unless the requirements of 8.2.10.1.2 apply, immediately following the display but no sooner than 15 minutes after the attempted firing, if the shell still has not fired, the following procedure shall be required:

(1) Any shells that were fired but are not exploded shall not be handled until at least 15 minutes have elapsed from the time the shells were fired.
(2) The fireworks then shall be treated as specified in either 8.2.10.1.1(2)(a) or 8.2.10.1.1(2)(b):
    (a) The fireworks shall be doused with water and allowed to remain undisturbed for at least 5 additional minutes before being placed in a plastic bucket or fiberboard box.
    (b) The fireworks shall remain undisturbed for at least 30 additional minutes before being placed in a plastic bucket or fiberboard box.

8.2.10.1.2 The requirements of 8.2.10.1.1 shall not apply where electrical ignition is used and the firing failure is electrical in nature or where the aerial shell was not fired intentionally, in which case the shell shall be permitted to be salvaged by the operator.

8.2.10.2 Disposal Instructions. The disposal instructions shall be provided by the supplier and shall be followed.

8.2.10.3* Area Control.

8.2.10.3.1 In manually fired displays, it shall be the responsibility of the shooter to accomplish the following:

(1) Determine when a shell does not fire from a mortar
(2) Warn others in the area
(3) Ensure that the mortar is marked to indicate the presence of an unfired aerial shell

8.2.10.3.2 In electrically fired displays or in the electrically fired portions of displays, the mortars from which aerial shells have not fired at the end of the display shall not be required to be marked.

8.2.10.3.3 Persons in the discharge site after the fireworks display shall conduct themselves as though unfired aerial shells present a hazard until otherwise advised by the operator.

8.2.11* Manual re-ignition of chain-fused aerial shells shall be attempted only at installed ignition points.

8.2.12* Following the display and before any public access to the site is permitted, the firing crew shall conduct an inspection of the fallout area for the purpose of locating any unexploded aerial shells or live components.

8.2.12.1 When the inspection specified in 8.2.12 has been completed, the following procedure shall be required:

(1) Any shells or live components found during the inspection that were fired but are not exploded shall not be handled until at least 15 minutes have elapsed from the time the shells were fired.
(2) The fireworks then shall be treated as specified in either 8.2.12.1(2)(a) or 8.2.12.1(2)(b):
    (a) The fireworks shall be doused with water and allowed to remain undisturbed for at least 5 additional minutes before being placed in a plastic bucket or fiberboard box.

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(b) The fireworks shall remain undisturbed for at least 30 additional minutes before being placed in a plastic bucket or fiberboard box.

8.2.12.2 The disposal instructions provided with the fireworks by the supplier shall be followed.

8.2.12.3 Where fireworks are displayed at night, a search of the fallout area shall be made immediately after the display and at first light the following morning by the operator or designated personnel acceptable to the AHJ.

8.3 Ground Display Pieces. All ground display pieces shall be constructed, assembled, and stored in accordance with NFPA 1124 or at the display site.

8.3.1 Setup and Site Preparation.

8.3.1.1 Unless the requirements of 8.3.1.2 or 8.3.1.3 are met to the extent that it is practical, all ground display pieces shall be positioned so that they will not be prematurely ignited by the discharge of aerial displays.

8.3.1.2 The requirements of 8.3.1.1 shall not apply where ground display pieces are to be fired electrically, in which case they shall be permitted to be located in the fallout area.

8.3.1.3 The requirements of 8.3.1.1 shall not apply where aerial shells have been preloaded, in which case ground display pieces shall be permitted to be located in the discharge area.

8.3.2 Dry grass or combustible materials located beneath ground display pieces shall be wet down before the display if they present a fire hazard.

8.3.3 Poles for ground display pieces shall be installed so that they do not fall over during functioning of the fireworks device.

Chapter 9 Electrical Ignition of a Display

9.1* General.

9.1.1* The intent of this chapter shall be as follows:

(1) To provide requirements for the correct setup and operation of an outdoor display of fireworks that is to be ignited using electrical means
(2) To provide requirements and minimum standards for the design and use of electrical firing units employed in electrically fired displays, including manually operated, automatically operated, and handheld firing units

9.1.2 Separation Distances.

9.1.2.1 Unless the requirements of 9.1.2.2 are met, where only electrical ignition is used, the operator and all assistants shall be positioned a minimum of 75 ft (23 m) from any mortar or shall be positioned behind a protective barrier approved by the AHJ.

9.1.2.2 The requirements of 9.1.2.1 shall not apply to the electrical ignition of lance work and other set pieces of similar low hazard.

9.1.3 Where both manual firing and electrical ignition are used during a display, the mortars to be used for manual firing shall be separated from the mortars to be used for electrical ignition by a distance of at least 25 ft (7.6 m).

9.2 Design of Electrical Firing Units.

9.2.1 Electrical firing units shall be manufactured specifically for use in the electrical ignition of pyrotechnic devices or explosives.

9.2.1.1 Unless the requirements of 9.2.1.2 are met, the manufacturer of electrical firing units shall supply specifications and instructions for the setup and use of each unit.

9.2.1.2 The requirements of 9.2.1.1 shall not apply where the electrical firing unit has been manufactured by the person operating the unit at the display.

9.2.2* Manual electrical firing units shall include a key-operated switch or similar device to reduce the possibility that unauthorized or unintentional firings can occur.

9.2.3* Manual electrical firing units shall be designed so that at least two positive actions are necessary to apply a firing current to an electric match.

9.2.4* Switches used to apply power to electrical firing units for testing, firing, or both shall indicate the function or functions of each switch.

9.2.5 A light, a beeper, or both shall activate when a manual electrical firing unit is armed.

9.2.6 Handheld Firing Units.

9.2.6.1 Unless the requirements of 9.2.6.2 are met, a handheld electrical firing unit shall have two switches or require two actions, one to arm the unit and one to fire the unit.

9.2.6.1.1 The handheld unit shall be designed so that it cannot be fired without first being armed.

9.2.6.1.2 Switches shall be identified, and the unit shall have a light or indicator that signals when the unit is ready to fire.

9.2.6.1.3 Handheld firing units that incorporate a capacitive discharge design shall dissipate the stored charge within 15 seconds after the arming switch is released.

9.2.6.2 The requirements of 9.2.6.1 shall not apply to blasting machines such as clackers, rotary generators, and plunger-type firing units that derive their energy from mechanical action.

9.2.7 Automatic electrical firing units shall incorporate some form of a "dead-man switch" so that all firings cease the moment that the switch is released.

9.2.8 If an electrical firing unit has a built-in test circuit, the firing unit shall be designed to limit the test current (into a short circuit) to 0.05 ampere or to 20 percent of the maximum current that can be applied to an electric match for 5 seconds at room temperature, without the match igniting the electric match being used, whichever is less.

9.2.9 Multitesters, such as volt-ohm meters, shall not be used for testing electric matches unless the tester's maximum current delivery potential has been measured and found to meet the requirements of 9.2.8.

9.2.10 Shunts of the type sometimes used in commercial blasting shall not be required on any electrical firing unit used for the ignition of pyrotechnic devices at an outdoor display of fireworks.

9.2.11 Electrical firing units shall be powered by batteries or isolated power supplies used for firing purposes only.

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9.2.11.1 If batteries are used, they shall be self-contained in the firing unit or otherwise covered or protected to prevent accidental contact with wires leading to the fireworks.

9.2.11.2 Electrical firing units powered by commercial power shall be permitted, provided that they incorporate an isolation transformer and that the transformer is located within the firing unit or elsewhere in the firing system.

9.3 Setup of Electrical Firing Units.

9.3.1 Inspection.

9.3.1.1 All portions of the electrical firing unit from the power supply to the electric match shall be visually inspected prior to the display by the shooter controlling the electrical firing unit or by an assistant.

9.3.1.2 The electrical firing unit shall not be in test or arm status during the inspection specified in 9.3.1.1.

9.3.2* The electrical firing unit shall be set up and located so that there is a clear line of sight to the mortars and to other parts of the discharge site, unless a spotter is in direct communication with the shooter controlling the electrical firing unit.

9.3.3 Only those persons necessary for the firing of the display shall be permitted in the vicinity of the electrical firing unit during the display.

9.3.4 Where fireworks are being loaded into mortars or otherwise set up for firing at the display site, cables from the electrical firing unit shall be disconnected.

9.3.5 Once the fireworks have been loaded or otherwise set up, testing of the circuits shall be permitted.

9.3.6 No persons shall be permitted in the immediate area of any fireworks that have been attached to the electrical firing unit when any circuit testing is performed.

9.3.7 If the testing of the circuits indicates that a problem exists, the following requirements shall apply:

(1) The operator or assistant shall be permitted to reinspect any cables, connections, or electric matches that are in question.
(2) The reinspection shall be performed only after the electrical firing unit has been switched off or disconnected from the power source.

9.4 Operation of the Electrical Firing Unit.

9.4.1 Prior to arming the electrical firing unit, the shooter controlling the unit shall confirm that no personnel are present in the mortar area that is to be electrically ignited.

9.4.2 The shooter controlling the electrical firing unit shall be provided with a means of communicating with the operator.

9.4.3* Where a significant malfunction exists at a discharge site, the following procedure shall be performed:

(1) The shooter controlling the electrical firing unit shall cease firing until the operator or an assistant visually inspects the discharge site for damage to mortars, equipment, or remaining fireworks and indicates that it is safe for firing to resume.
(2) The electrical firing unit shall be switched off or disconnected while the inspection is being performed.

9.4.4 When a serious electrostatic discharge hazard exists, such as during an electrical storm, all electrostatic discharge–sensitive operations shall be suspended, and personnel shall withdraw to a safe location.

9.5 Post-Display Operations.

9.5.1 After the completion of the display, the electrical firing unit shall be switched off and all cables disconnected prior to any cleanup or other work in the display site.

9.5.2* After the display, personnel shall not enter the discharge site for a period of time that the operator deems necessary for safety, after which the discharge site shall be inspected by the operator or assistants for any unfired devices.

9.5.2.1* Unfired devices shall be permitted to be either of the following:

(1) Fired in accordance with this code
(2) Packaged and returned to the supplier in compliance with all applicable regulations

Chapter 10 Qualifications

10.1 Operator Qualifications.

10.1.1 The operator shall be at least 21 years old and licensed or approved by the AHJ in accordance with any and all applicable federal, state, and local laws.

10.1.2* Applicants for licensing as an operator shall provide evidence of actual experience as an operator or assistant as part of demonstrating competency to the AHJ.

10.1.3 Applicants for licensing as an operator shall successfully complete a written examination of laws, regulations, and safety practices pertaining to the discharge of fireworks that shall be administered by the AHJ or shall otherwise demonstrate knowledge of these areas.

10.2 Assistants. All assistants shall be trained in the duties they are to perform, be under the direct supervision of the operator, and be at least 18 years old.

10.3 Permits Required.

10.3.1* Prior to performing the fireworks display, the operator, supplier, or sponsor shall obtain a display permit from the AHJ.

10.3.1.1 If the display permit is denied by the AHJ, the AHJ shall notify the permit applicant and specify in writing the reasons for the denial.

10.3.1.1.1 The permit applicant shall be permitted to resubmit the display permit application to address the reasons specified by the AHJ for denial of the display permit.

10.3.2 As part of the permit process, the operator, supplier, or sponsor shall demonstrate financial responsibility for the fireworks display to the AHJ by providing proof of insurance or by other approved means.

10.3.3 The operator or supplier shall maintain any federal or state permit(s) or license(s) required to possess and use fireworks.

10.3.4 The AHJ shall meet all the requirements of Chapter 10 if the AHJ acts as the operator of the display.

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Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1.2(1) For additional information see NFPA 1124.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment, or materials, the "authority having jurisdiction" may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The "authority having jurisdiction" may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA standards in a broad manner because jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.3 Code. The decision to designate a standard as a "code" is based on such factors as the size and scope of the NFPA standard, its intended use and form of adoption, and whether it contains substantial enforcement and administrative provisions.

A.3.3.1 Aerial Shell. Comets and mines are not aerial shells. The shells are most commonly 3 in. to 6 in. (76 mm to 152 mm) outside diameter and are fired from mortars. Upon firing, the fuse and lift charge are consumed.

A.3.3.2 Assistant. The duties of an assistant include tasks such as setting up the equipment and fireworks, loading mortars (loader), spotting the bursting location of aerial shells (spotter), tending a ready box (ready box tender), igniting the fireworks (shooter), striking the equipment, and cleaning the discharge site.

A.3.3.3 Barrage. Mortars are loaded prior to the display, and the aerial shells are chain fused to fire in rapid sequence.

A.3.3.4 Battery. This term is not to be confused with an electrical battery used to provide a source of current.

A.3.3.5 Break. Aerial shells can be either single-break (having only one burst) or multi-break (having two or more bursts).

A.3.3.7 Chain Fusing. Finales and barrages typically are chain fused.

A.3.3.8 Comet. A comet is not an aerial shell or mine. Comets frequently leave a trail of sparks as they rise in the air, and they sometimes burst into smaller fragments at their zenith.

A.3.3.9.1 Fireworks Device. Any combination of fireworks, including display fireworks, consumer fireworks, or professional-use-only products, that could be used as a fireworks device in a fireworks display.

A.3.3.9.2.1 Pyrotechnic Effect Simulation Equipment. When evaluating the potential risks presented by pyrotechnic effect simulation equipment, the AHJ should consider the level of hazard the device poses compared to similar pyrotechnics in the location where the device is to be used. The AHJ should also evaluate the level of operator training required in conjunction with the hazard presented.

RESquibs can be used as part of the pyrotechnic effect simulation equipment. [**1126,** 2026]

A.3.3.10 Electrical Firing Unit. A firing unit normally has switches to control the routing of the current to the devices to be used during the display and also might contain test circuits and warning indicators. Units can be manual, automatic, or handheld.

A.3.3.10.1 Automatic Electrical Firing Unit. The unit is attached by wires or cables to junctions that are connected to the electric matches, which, in turn, are attached to fireworks devices. Automatic units often are operated by magnetic tape or by computer.

A.3.3.10.2 Handheld Electrical Firing Unit. The unit is connected directly to the electric matches by means of wires.

A.3.3.10.3 Manual Electrical Firing Unit. The unit contains wires or cables that are attached to junctions that are, in turn, connected to the electric matches.

A.3.3.11 Fallout Area. The shells burst over the area, and unsafe debris and malfunctioning aerial shells fall into this area. The fallout area is the location where a typical aerial shell dud falls to the ground, depending on the wind and the angle of mortar placement. The term does not include areas where cardboard and nonhazardous remnants of pyrotechnic devices might fall to the ground.

A.3.3.12 Finale. The mortars are loaded prior to the display, and the aerial shells are chain fused to fire in rapid sequence.

A.3.3.13 Fire (verb). Fireworks can include, but not be limited to, aerial shells, ground display pieces, proximate pyrotechnics, and other pyrotechnic devices intended for entertainment purposes.

A.3.3.15 Fireworks. Toy caps for use in toy pistols, toy canes, toy guns, and novelties and trick noisemakers are not considered to be fireworks . The regulations referred to limit the explosive content of each toy cap to not more than an average of 0.25 gr (16.2 mg). Also, each package containing such caps has to be labeled to indicate the maximum explosive content per cap. For information on the use of model rockets and model rocket motors, see NFPA 1122. For information on the use of high power rockets and high power rocket motors, see NFPA 1127. Model rockets, model rocket motors, high power rockets, and high power rocket motors designed, sold, and used for the purpose of propelling recoverable aero models are not considered to be fireworks. [**1124,** 2026]

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A.3.3.15.1 Consumer Fireworks. Consumer fireworks are normally classed as Explosives, 1.4G and described as UN 0336, "Fireworks," by the US Department of Transportation (US DOT) . Some small devices designed to produce audible effects are included, such as whistling devices, ground devices containing 0.8 gr (50 mg) or less of explosive composition (salute powder), and aerial devices containing 2 gr (130 mg) or less of explosive composition (salute powder) per explosive unit. Consumer fireworks contain limited quantities of pyrotechnic composition per unit and do not pose a mass explosion hazard where stored. Therefore, they are not required to be stored in a magazine.

A.3.3.15.2 Display Fireworks. Display fireworks are described as UN 0335, "Fireworks," and are classified as Explosives, 1.3G by the US Department of Transportation (US DOT). [**1124,** 2026]

Display fireworks include, but are not limited to, the following:

(1) Salutes or firecrackers containing more than 2 gr (130 mg) of explosive composition (salute powder)
(2) Aerial shells containing more than 2.1 oz (60 g) of total pyrotechnic and explosive composition
(3) Other display pieces that exceed the limits for classification as consumer fireworks

[**1124,** 2026]

Such fireworks are also described as fireworks, 49 CFR 172 by the US DOT. [**1124,** 2026]

A.3.3.15.3 Professional-Use-Only Product. Professional-use-only products include, but are not limited to, display fireworks, theatrical fuses, igniters, or binary materials.

A.3.3.18 Ground Display Piece. Ground display pieces can include, but not be limited to, the following devices: fountains (gerbs), wheels, and "set pieces."

A.3.3.19 Hazardous Debris. Confetti, lightweight foam pieces, feathers, novelties, and so forth, are not to be construed as hazardous debris.

A.3.3.20.1 Electrical Ignition. Typically, electric matches are attached to or inserted into fireworks devices prior to the display and are connected to wires leading back to an electrical firing unit. During the display, the operator or an assistant controls the ignition of the fireworks using the electrical firing unit.

A.3.3.21 Lance. Lances are mounted on a frame and fused so that ignition of all tubes is nearly simultaneous.

A.3.3.22 Lift Charge. A time delay fuse then ignites the main part of the shell, producing the desired effect.

A.3.3.24.2 Electric Match. When a sufficient electric current is passed through the wire circuit, the heat that is generated ignites the pyrotechnic composition, producing a small burst of flame. This flame can be used to ignite a fuse or a lift charge in a fireworks device. For the purposes of this code, the term *electric match* also refers to other similar technologies in which an electric current is used to produce a high temperature for ignition purposes.

A.3.3.24.3 Quick Match. While an exposed black match burns slowly, quick match propagates flame extremely rapidly, almost instantaneously. Quick match is used in fuses for aerial shells and for simultaneous ignition of a number of pyrotechnic devices, such as lances in a ground display piece.

A.3.3.25 Mine. A mine is a fireworks device designed to project stars and/or other effects or components into the air from a mortar. A black powder lift charge at the base of the mine ignites its contents and projects them into the air usually to an altitude that is lower than that reached by an aerial shell of the same diameter. The visual effect is similar to that of a flowerpot. Mines are not aerial shells or comets.

A.3.3.32 Pyrotechnic Material (Pyrotechnic Special Effects Material). Such a chemical mixture consists predominantly of solids capable of producing a controlled, self-sustaining, self-contained exothermic chemical reaction that results in heat, gas, sound, or light, or a combination of these effects. The chemical reaction functions without external oxygen. [**1124,** 2026]

A.3.3.33 Pyrotechnic Professional. Knowledge and training can be proven via any of the following methods (or a combination thereof):

(1) A valid proximate pyrotechnics or commercial display operator's license issued by the authority having jurisdiction
(2) Completion of a recognized education or training curriculum acceptable to the authority having jurisdiction
(3) Prior experience or demonstrated skill and testing acceptable to the authority having jurisdiction

A.3.3.37 Ready Box Tender. Tasks that a ready box tender might perform include making sure sparks do not enter the ready box and dispensing aerial shells to the loader as needed.

A.4.1.1 For example, 2 in. (50 mm) aerial shells, mines, and comets should only be used in 2 in. (50 mm) mortars. In addition, 3 in. (76 mm) aerial shells, mines, and comets should only be used in 3 in. (76 mm) mortars, etc.

A.4.1.2 If there is doubt regarding whether aerial shells were manufactured to operate safely or whether the mortars and shells are correctly sized, it is recommended that test firings be conducted in order to establish whether they perform safely. It generally is believed that shells should be constructed so that the difference between the inside diameter of the mortar and the outside diameter of the shell is no less than ⅛ in. (3.2 mm) for all shell sizes. Furthermore, it generally is believed that aerial shells should be constructed so that the difference between the inside diameter of the mortar and the outside diameter of the shell is no more than ¼ in. (6.4 mm) for 2 in. to 3 in. (51 mm to 76 mm) shells; ⅜ in. (9.4 mm) for 4 in. to 6 in. (102 mm to 152 mm) shells; or ½ in. (12.7 mm) for shells larger than 6 in. (152 mm).

A.4.1.3 Shells that function to deploy a parachute suspending burning pyrotechnic composition can present additional safety concerns if the parachute does not deploy as designed or if the shell is fired in high winds.

A.4.1.3.1 Examples of labeling information are as follows:

(1) The description of the size of the shell, comet, or mine [e.g., 2 in. (50 mm), 3 in. (76 mm), etc.]
(2) The description of the type of shell, comet, or mine (e.g., color shell, salute shell, silver comet, color mine, two-break with report, etc.)

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A.4.2.1 This requirement applies to, but is not limited to, ground display pieces, wheels, roman candle batteries, and multishot devices.

A.4.2.2.2 For displays conducted on floating platforms, barges, and trailer-mounted displays, the preparation site can be in a different location than the display site.

A.4.2.2.4 Fireworks, especially those with electric matches installed, should not be dropped. They should be kept in closed shipping cartons until they are sorted, inspected, prepared, and loaded or set up for display.

A.4.2.2.5 The assembly, minor repair, installation of fuses and electric matches, and similar activities when done at a display site are not considered manufacturing but are part of the normal activities needed to prepare for a display.

A.4.2.4.3 An example of additional protection to ready boxes is the use of a flame-resistant tarpaulin meeting the requirements of NFPA 701.

A.4.3.1 The requirement for careful inspection of mortars is of particular importance for paper mortars that can sustain undetected damage to their interiors that can result in serious malfunctions. Defects can include dents, bent ends, damaged interiors, splits and cracks, and damaged plugs.

A.4.3.2 If there is doubt concerning the proper angling of mortars, it is appropriate to fire one or more test shells for verification.

A.4.3.3 To the extent practical, where mortars are to be reloaded during a display, groups of one size of mortars should not be placed adjacent to mortars of only 1 in. (25 mm) difference in diameter. This reduces the likelihood that shells are loaded into oversized mortars. For example, an arrangement of mortar groups such as 5 in., 3 in., 6 in., and 4 in. (127 mm, 76 mm, 152 mm, and 102 mm) is greatly preferred to an arrangement of 3 in., 4 in., 5 in., and 6 in. (76 mm, 102 mm, 127 mm, and 152 mm).

A.4.3.6 Malfunctions can present a hazard from dangerous flying debris. It is appropriate that measures such as personal protective equipment, barriers, or alternate procedures be utilized to reduce the exposure to the hazard. Where possible, the narrow side of the trough should face the greatest number of spectators, and the firing progression should develop in a direction away from the spectators.

A.4.3.8 The specifications in Table A.4.3.8(a) through Table A.4.3.8(d) are not intended to be construed as absolute minimums. Experience has demonstrated that these recommendations function reliably in use.

If there is reason to doubt that the strength of a mortar is adequate, a test can be devised to determine whether its strength is sufficient. One possible strength test for mortars is to fire the heaviest aerial shell of a given size to be used with a charge of lift powder that is 1.5 times the normal quantity. This approximately doubles the normal stress on the mortar. It is not appropriate to conduct this test at the display site. In addition, mortars meeting the specifications of Table A.4.3.8(a) through Table A.4.3.8(d) generally are believed to have ample strength.

A.4.3.8.1 HDPE mortars (and possibly other types) can lose significant strength if fired repeatedly over a relatively short period of time. Accordingly, when mortars will be reloaded during a display, it is appropriate to consider this potential problem.

Table A.4.3.8(a) Steel Mortars: Adequate Mortar Wall Thickness in Inches

Mortar ID	Spherical	Cylindrical Single-Break	Cylindrical Multi-Break
2	0.03	0.10	0.15
2.5	0.03	0.11	0.19
3	0.04	0.11	0.21
4	0.05	0.12	0.23
5	0.06	0.13	0.25
6	0.07	0.14	0.27
8	0.09	0.16	0.31
10	0.11	0.18	0.36
12	0.13	0.20	0.40
16	0.17	0.24	0.55
>16	NA	NA	NA

For SI units, 1 in. = 25.4 mm.
NA: Data not currently available.
Note: The tensile strength of steel pipe should be at least 40,000 psi (275,800 kPa).

Table A.4.3.8(b) Paper Mortars (Convolute or Spiral): Adequate Mortar Wall Thickness in Inches

Mortar ID	Spherical	Cylindrical Single-Break	Cylindrical Two-Break
2	0.18	0.25	0.37
2.5	0.18	0.25	0.37
3	0.25	0.25	0.37
4	0.25	0.33	0.50
5	0.31	0.42	0.62
6	0.37	0.50	0.75
8	0.50	NA	NA
10	0.62	NA	NA
12	0.75	NA	NA
16	NA	NA	NA

For SI units, 1 in. = 25.4 mm.
NA: Data not currently available.
Note: The cross-grain tensile strength of the paper should be at least 2300 psi (16,000 kPa).

A.4.3.10 Where there is concern that a mortar is too short to cause an aerial shell to be propelled to a safe altitude, a test firing should be conducted. However, it generally is believed that mortars of the lengths specified in Table A.4.3.10 are sufficient.

The lengths specified in Table A.4.3.10 are not intended to be construed as absolute minimums; however, experience has demonstrated that these recommendations function reliably in use.

A.4.4.1 The use of securely positioned racks located on barges and trailers can be permitted, provided that all other code requirements are met.

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Table A.4.3.8(c) High-Density Polyethylene (HDPE) Mortars: Adequate Mortar Wall Thickness in Inches

Mortar ID	Spherical	Cylindrical Single-Break	Cylindrical Two-Break
2	0.12	0.17	0.17
2.5	0.12	0.17	0.17
3	0.15	0.17	0.17
4	0.20	0.25	0.25
5	0.25	0.25	0.25
6	0.30	0.32	0.32
8	0.32	NA	NA
10	0.32	NA	NA
12	0.37	NA	NA
>12	NA	NA	NA

For SI units, 1 in. = 25.4 mm.
NA: Data not currently available.
Note: The tensile strength of plastic should be at least 3300 psi (22,750 kPa).

Table A.4.3.8(d) Fiberglass Reinforced Epoxy Mortars: Adequate Mortar Wall Thickness in Inches

Mortar ID	Spherical	Cylindrical Single-Break	Cylindrical Two-Break
2	0.07	0.11	0.11
2.5	0.07	0.11	0.11
3	0.07	0.11	0.11
4	0.11	0.11	0.11
5	0.11	0.11	0.11
6	0.11	0.11	0.11
8	0.25	NA	NA
10	0.25	NA	NA
12	0.25	NA	NA
>12	NA	NA	NA

For SI units, 1 in. = 25.4 mm.
NA: Data not currently available.
Note: The tensile strength of fiberglass should be at least 11,000 psi (76,000 kPa).

Table A.4.3.10 Minimum Inside Mortar Length in Inches

Mortar ID	Single-Break	Two-Break	Up to Four-Break
3	15	18	21
4	20	23	27
5	24	28	32
6	28	32	37
8	34	40	46
10	40	46	54
12	46	52	62

For SI units, 1 in. = 25.4 mm.

A.4.4.5 Examples of materials for use in providing added support include wood and flat stones.

A.4.4.6 Where practical, additional separation distances between buried mortars should be used. Additional separation distances for buried mortars provide more room for loaders and shooters to work and reduce the chances of crew injury.

A.4.5.1 Audience safety should be considered during the orienting and angling of mortar racks and bundles.

A.4.5.1.1 The code does not permit the loading of multiple, individually lifted aerial shells into a single mortar. This section permits the use of commercially manufactured devices that contain multiple spherical aerial shells assembled with a single lift charge. Common names for these items include "peanut shells," "double-bubble," "stacked shells," and "piled shells."

A.4.5.1.2 See A.4.5.1.1.

A.4.5.7 The materials used in rack construction vary widely in the industry. There is no single material or construction method that is uniquely acceptable for fireworks display racks. This performance-based requirement addresses the concern about mortar rack construction and provides direction to ensure operator and audience safety during fireworks displays.

Many accidents characterized as rack-related accidents might actually be related to violations of current code such as mortar stabilization, shell type, or chain fusing. Mortar rack construction might be neither a cause of these accidents nor a means by which such accidents might be best prevented in the future.

Examples of the systems and methods used to ensure safety with racks include the following:

(1) Different methods for securing and stabilizing the racks
(2) Constructing additional containment and/or framework structures
(3) Utilizing different types of shells
(4) Strategic placement of the devices in the field
(5) Using natural barriers and/or berms
(6) Using other barriers (e.g., metal dumpsters)
(7) Strategic placement of the audience
(8) Using other, smaller caliber shell mortar racks to surround and contain the larger 5 in. and 6 in. (127 mm and 152 mm) shell mortars
(9) Utilizing chain fusing alternatives
(10) Increasing the separation distance as prescribed by the code related to the use of chain fusing and other actions
(11) Consideration for mortar rack construction and the materials used for construction

A.4.6.1 Aboveground racks should be constructed to withstand a catastrophic malfunction in a mortar. Wooden racks should have sides and bottom plates of at least 2 in. (51 mm) nominal thickness. The racks should be boxed on both sides at the top and bottom by 1 in. × 6 in. (25.4 mm × 152 mm) nominal thickness boards or ½ in. (13 mm) thick plywood. Blocks of 2 in. (51 mm) nominal thickness should be attached to the horizontal boards between each mortar with an inside diameter greater than 3 in. (76 mm). Boards should be fastened by nails, screws, or other fasteners that penetrate a minimum of 1 in. (25.4 mm) into the member to which a board is attached. Racks should be secured to prevent tipping by attaching stakes or spikes driven into the ground, banding, using A-frames, or using other equivalent means. Aboveground wood frame mortar racks made of lightweight mortar materials such as paper, HDPE, or fiberglass generally cannot withstand a catastrophic aerial shell malfunction in a mortar.

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A.4.6.1.1 Mortar racks containing chain-fused aerial fireworks should be positioned perpendicular to spectator viewing areas, where practical, to maximize audience safety.

A.4.6.2.2 A boxed finale item can be fired at any point during the display.

A.4.6.3 Stakes, sandbags, trenches, boxes, screens, or barriers are among the common means used to secure chain-fused aerial fireworks devices that require additional stabilization.

A.4.6.4 This performance-based requirement addresses the concern about chain-fused aerial fireworks devices and provides direction to ensure operator and audience safety during fireworks displays.

Examples of the systems and methods used to ensure safety with chain-fused devices include the following:

(1) Different methods for securing and stabilizing the devices
(2) Constructing additional containment and/or framework structures
(3) Utilizing different types of shells
(4) Strategic placement of the devices in the field
(5) Using natural barriers and/or berms
(6) Using other barriers (e.g., metal dumpsters)
(7) Strategic placement of the audience
(8) Using other, smaller caliber shell mortar racks to surround and contain the larger 5 in. and 6 in. (127 mm and 152 mm) shell mortars
(9) Utilizing chain fusing alternatives
(10) Increasing the separation distance as prescribed by the code related to the use of chain fusing

A.4.7.5.1 Methods such as jacks, trailer dollies, and tires could be used to ensure the total platform surface area is stabilized during firing operations.

A.5.1.2.2 By definition, the "display site" includes the discharge site, the fallout area, and the required separation distances. Therefore, the dimensions of the display site, at a minimum, include a fallout area that allows for the separation distances required for the fireworks planned in the display. Generally, the display site and the fallout area can be considered the same thing; however, where the fallout area is to be limited within a larger display site, the location and dimensions of the fallout area should be included. Allowing the fallout area to be located anywhere in the display site offers the greatest flexibility for on-site adjustments while maintaining required separation distances.

A.5.1.2.5 Esthetic use of a display site often requires individual fireworks devices to be placed in different locations within the discharge site. For example, a front of smaller devices might be displayed closer to the spectators, with the largest shells placed farther away and behind the smaller devices. The display site itself should comply with 5.1.3, but, within that display site, the individual fireworks devices could be placed in different locations provided that each device is at the minimum or greater separation distance from the spectators as required in the subordinate sections of 5.1.3 and in Table 5.1.3.1, where applicable. There is no requirement that all the devices be placed together at the distance required for the largest device.

Mortar angles, potential wind speed and direction at the time of the display, overhead objects, and other variables, such as the type, volume, and condition of combustible materials, domestic animals, etc., must also be considered when establishing separation distances.

A.5.1.3 Where more than one shooter is to manually ignite the aerial shells for an outdoor fireworks display, the line of mortars should be separated in some manner, and only one shooter should be igniting shells in each area.

A.5.1.3.5.1 Examples of ground display pieces of low hazard potential are items such as lancework, gerbs or fountains, and illuminations.

A.5.1.3.5.2 Examples of ground display pieces with greater hazard potential are items such as large wheels with powerful drivers and items employing large salutes.

A.5.1.3.7 Caution should be used to ensure that flammable liquid flame effect devices using black powder or an equivalent propellant and used in displays in conjunction with projectile fireworks devices are protected from premature ignition by debris or other components of the projectile fireworks.

A.5.1.3.8.1 Examples of powdered solids that are typically used for fireball effects are sawdust, lycopodium, powdered milk, walnut husks, etc. Solid fuel fireball effects should not utilize flash powder or similar combinations of metal powder and oxidizer mixes as the fuel element of a fireball. The calculated volume or device size can be used to determine the required separation distance.

The volume of a cylinder can be calculated using the following formula:

[A.5.1.3.8.1]

$$V = \pi \times r^2 \times h$$

where:
V = volume of the cylinder in in^3
r = radius
h = height

To obtain that volume in gallons, multiply the number of $in.^3$ by 0.0043 to convert it into US gallons or 0.0036 for Imperial gallons.

A.5.1.3.8.2 Types of pyrotechnic inserts include comets, stars, etc. and not metal powders for the effect.

A.5.1.3.8.6 If utilizing metal bowls to contain the black powder or other lift charge and the solid fuel is not to be immediately loaded, an opaque covering such as foil or a similar cover should be used to prevent premature ignition of the e-match or another igniter.

A.5.1.4.1 See NFPA 101 for definitions of health care and detention and correctional facilities.

A.5.1.4.3 To determine whether materials are considered to possess these hazards, see NFPA's *Fire Protection Guide to Hazardous Materials*.

A.5.1.5.1 The presence of a modest number of trees and shrubs should not be considered a safety problem, provided that they are not so numerous as to make it significantly more difficult to locate unexploded aerial shells or to pose a serious fire safety threat.

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A.5.2.1.1 Figure A.5.2.1.1 illustrates some of the requirements for a permitted display site where mortars are placed vertically, such as might be the case for an electrically ignited display.

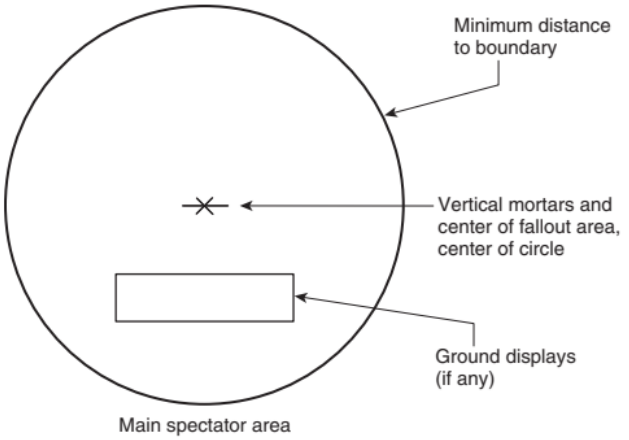
Minimum distance to boundary
Vertical mortars and center of fallout area, center of circle
Ground displays (if any)
Main spectator area

FIGURE A.5.2.1.1 Typical Layout for a Display Site with Vertically Positioned Mortars.

A.5.2.1.4.1 For typical aerial shells, a mortar tilt angle of approximately 1.5 degrees into the wind for each 5 mph (8 km/hr) of wind speed aloft is sufficient to correct for the fallout of dud shells. However, this mortar angling has little effect on the fallout of other hazardous debris from the firing of aerial shells, comets and mines, and roman candles and cakes.

A.5.2.1.4.2 Figure A.5.2.1.4.2 illustrates some of the requirements for a permitted display site where mortars are to be angled away from the main spectator area and offset (shown as *d* in the figure) up to one-third the separation distance toward the spectators as specified in Table 5.1.3.1.

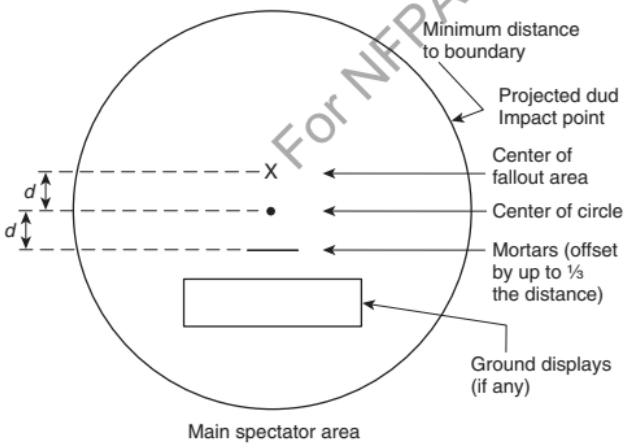

FIGURE A.5.2.1.4.2 Typical Layout for a Display Site Using Mortars Angled Away from the Main Spectator Area. The distance, *d*, should be at least one-sixth but not more than one-third the radius of the circle, indicating the minimum distance to the secured boundary.

A.5.2.1.4.3 For typical aerial shells, a mortar tilt angle of approximately 8 degrees is required to achieve the full one-third displacements of mortar location and the center of the fallout area from the center of the display site.

A.6.2.1 The types of fireworks and placement of the fireworks mortars and accompanying equipment should be such that, when fired, the stability of site structures and the seaworthiness of the floating vessels and floating platforms are not jeopardized.

A.6.3.1 An example using the following formula for determining the minimum display setup is provided:

[A.6.3.1a]

$$\frac{\left[\begin{pmatrix}\text{total no. of 3 in.}\\ \text{mortars}\times 3\end{pmatrix}+\begin{pmatrix}\text{total no. of 4 in.}\\ \text{mortars}\times 4\end{pmatrix}+\begin{pmatrix}\text{total no. of 5 in.}\\ \text{mortars}\times 5\end{pmatrix}+\ldots\right]}{2}$$

$$= \text{minimum display setup}$$

EXAMPLE: A display containing one hundred 3 in. (76 mm) shells, fifty 4 in. (102 mm) shells, twenty 5 in. (127 mm) shells, ten 6 in. (152 mm) shells, and five 8 in. (203 mm) shells would require the following minimum display setup area:

[A.6.3.1b]

$$\frac{[M_1\times D_1]+[M_2\times D_2]+[M_3\times D_3]+\ldots[M_n\times D_n]}{2}$$

$$\frac{(100\times 3)+(50\times 4)+(20\times 5)+(10\times \mathbf{6})+(5\times 8)}{2}$$

$$=\frac{300+200+100+60+40}{2}$$

$$=\frac{700}{2}=350\ \text{ft}^2\ (32.5\ \text{m}^2)$$

where:
M_n = number of each mortar size, from 1 to n
D_n = inside diameter of each size mortar [in. (mm)]

Therefore, the minimum display setup area is 350 ft^2 (32.5 m^2).

A.6.3.2.4 Temporary structures and barriers can interfere with overboard activities or procedures and the ability to monitor for, see, and quickly recover personnel who go overboard voluntarily or otherwise.

In addition, temporary structures and barriers placed near a barge or floating platform present a hazard to navigation for vessels and personnel attempting to access or depart from the site. Such temporary structures and barriers might also require placement or control measures that could impact safety.

A.6.3.3 Floating platforms constructed of wood or other combustible material can be used, provided that the surfaces of such platforms have been protected from fire by means acceptable to the AHJ. These floating platforms should also be of sufficient construction and configuration to safely allow the firing of the display.

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A.6.4.8 Consideration should be given to the conditions that could affect the separation distances. Greater distances could be required to allow for the effect of sea conditions, wind, drift of the vessel at anchor, and so forth.

A.6.4.9 The primary duty of the fireworks crew and crews on other safety-related vessels is ensuring safety. Duties that are not safety related, such as placing or operating cameras or recording systems, distract from those primary duties and should not be permitted unless the operator is directing them. This requirement is not intended to restrict common crew and vessel support functions.

A.6.5 Communication could be needed between the display operator and the tug operator, spotter, the AHJ, life safety and fire safety personnel, and any other necessary personnel.

A.6.6 Necessary personnel should include, but are not limited to, display crew and spotters, fire department inspectors, and vessel operators.

A.6.7.1 Fuel tanks are deemed essential to perform the display for self-propelled vessels and for vessels controlling, marshaling, or adjoining a non-self-propelled vessel or platform from which fireworks are being discharged.

A.7.2.1 The types of fireworks and placement of the mortars and accompanying equipment should be such that when fired, the stability of the site structures should not be jeopardized.

A.7.5.4 It is desirable to allow very small openings in the coverings of those sewer vent pipes so that the pipe can still vent gases.

A.8.1.1 The AHJ should be consulted well enough in advance so that the required fire protection can be arranged. Fire protection could include portable fire extinguishers for the discharge site and standby fire apparatus for protection down range.

A.8.1.2 Monitors should wear some distinctive identification (e.g., badges, brightly colored vests).

A.8.1.3 Although the operator is permitted to participate actively in the firing of the fireworks display, safety should be the primary concern of the operator.

A.8.1.3.1 In most situations, it is believed that it is appropriate to have one ready box tender tending each ready box or shell storage area in use at a given time. Similarly, it is believed that there should be two loaders reloading shells into mortars for each person igniting the aerial shells. Unless racks of chain-fused shells are being fired, it generally is believed that a single shooter can safely ignite no more than approximately 10 shells per minute. If a greater rate of firing is desired, more than one shooter should be lighting them. The AHJ, sponsor, and others (such as barge and tow operators) should defer to the operator to determine the number of assistants required because the operator has primary responsibility for safety, as stated in 8.1.3.

A.8.1.3.4 The appropriate personal protective equipment (PPE) for each person is determined by conducting a hazard assessment of that person's duties at the fireworks display, as required by the US Occupational Safety and Health Administration (OSHA).

A.8.1.4.2 In considering when wind speed is excessive for the reasonably safe performance of a fireworks display, there are two primary considerations, as follows:

(1) The potential for an increased risk of hazardous debris from the display falling into the spectator areas
(2) The potential for an increased probability of fire that is made excessively difficult to control

An increased fallout hazard occurs when the wind is traveling in a direction toward one or more spectator areas. Under these circumstances mitigation strategies that should be considered are as follows:

(1) To move the spectators out of the path of the fallout
(2) To redirect the fallout by moving the fireworks or re-angling the mortars
(3) To increase the separation distance between the fireworks and the spectators
(4) To modify the content of the display to eliminate the fireworks of greatest concern
(5) To delay the display until the weather conditions have improved
(6) To implement a combination of these strategies

Some possible mitigation strategies to be considered regarding fire risks are as follows:

(1) To water down the areas and items of concern immediately before the display
(2) To redirect the fallout by moving the fireworks or re-angling the mortars
(3) To increase the separation distance between the fireworks and the areas containing the fire hazards
(4) To modify the content of the display to eliminate the fireworks of greatest concern
(5) To increase the amount of suppression equipment and personnel in the immediate area
(6) To delay the display until weather conditions have improved
(7) To implement a combination of these strategies

A.8.1.9.1 This requirement is not intended to include ambient levels of alcohol commonly present in his or her system.

A.8.2.1 It should be noted that shell fuses can be damaged by rough handling. Therefore, appropriate care should be taken when handling shells and fuses.

A.8.2.2 It generally is believed that it is not safe to be loading mortars within 10 ft (3 m) of mortars that are being fired. When loading a shell into a recently fired mortar, the loader should crouch alongside the mortar, and his or her back should be kept facing the area where shells are being fired.

A.8.2.4 A gentle tug on the fuse usually can determine whether a shell has been properly seated at the bottom of the mortar.

A.8.2.6 Fusees and portfires can be mounted on a holder of some sort so that the shooter is an additional distance away. Wooden broom handles and other lightweight materials make serviceable holders.

A.8.2.9.2.2 Alternative means of protection should include a sturdy barricade, the placement of sandbags or similar protection on the shooter side of the mortar, or other alternative protection acceptable to the AHJ.

A.8.2.10 The operator and assistants should use extreme caution whenever approaching or handling a malfunctioned live aerial shell. Before approaching or handling the shell, as much time as practical following the malfunction should be

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allowed to pass. This minimizes the possibility that the shell will contain a live spark that could cause the shell to explode unexpectedly. Operators or assistants never should attempt to dry or repair a damaged shell. In all such cases, the supplier should be contacted for disposal instructions.

A.8.2.10.3 Where aerial shells are fired electrically or as a finale or barrage, it often is difficult to detect when unfired shells remain in the mortars. Therefore, it is advisable to use some method to aid in identifying when shells have not fired properly. One such method is to place a strip of paper tape over the mouth of each mortar; the presence of unbroken tape is then a certain indication that the shell has not fired. However, it should be noted that broken tape is *not* a certain indication that the shell *has* fired. It always should be assumed that the mortar is loaded.

A.8.2.11 Remaining within 25 ft (7.6 m) of chain-fused aerial shells after their ignition, for the purpose of manual re-ignition, is unreasonably dangerous. Similarly, the act of manual re-ignition of chain-fused aerial shells is dangerous unless re-ignition is attempted at properly installed ignition points. The necessity for such actions can be avoided through the use of redundant fusing or multiple ignition points.

A.8.2.12 The operator and assistants should use extreme caution whenever they approach a malfunctioned live aerial shell. Before approaching or handling the shell, personnel should allow as much time to pass as practical following the malfunction. This precaution minimizes the possibility that the shell still contains a live spark that could cause the shell to explode unexpectedly. Operators or assistants never should attempt to dry or reuse a shell that has malfunctioned. In all such cases, the supplier should be contacted for disposal instructions.

A.9.1 In an electrically fired display, all aerial shells to be used in the display normally are loaded prior to the firing of the first shell. A mortar therefore is required for each shell. Other fireworks devices such as set pieces, roman candle batteries, and fountains that are to be fired during the display are also set up for firing prior to the display and ignited electrically. It therefore is normally not necessary for any personnel to be in the immediate area during the firing of the display.

A.9.1.1 Electrical ignition often is used for larger displays, for displays fired on frequent occasions at a fixed location, and for other displays where precise control over the timing of the fireworks is desired for aesthetic reasons.

A.9.2.2 Switches should have labels under or above each switch. The labels should use either letters or numbers.

A.9.2.3 For example, this requirement might be accomplished with two switches in series, both of which need to be operated for current to flow to the electric match.

A.9.2.4 A switch used to power the electrical firing unit for testing should be a different style from that used to ignite electrical matches and also should be provided with lights to indicate the status of the unit.

A.9.3.2 The electrical firing unit should be placed on a flat surface or table, and it should be provided with some form of shield or other means of protection where located near the firing site.

A.9.4.3 A significant malfunction normally means that a fireworks device has violently exploded in a mortar and there is a possibility that mortars have been dislodged from their intended placement in racks or in the ground. A flowerpot or low burst normally does not require stopping the display to check the mortar area.

A.9.5.2 A delay of 15 minutes or more is recommended before approaching areas that might contain hangfires. Chain-fused and multishot devices are prone to this behavior.

A.9.5.2.1 Because much of the ability to control the audience is lost once the display is concluded, it normally is not recommended to fire leftover aerial shells. However, under favorable circumstances, it is possible and can be desirable to ignite any unfired set pieces, fountains, roman candles, or other low-level devices.

A.10.1.2 Applications for licenses based on experience as an assistant should demonstrate that the assistant actively participated in the operation and safety of fireworks displays. This experience should represent to the AHJ that the operator mentored the assistant in developing the skills as a future operator.

A.10.3.1 In some jurisdictions only municipalities or civic organizations are issued display permits, while in others only licensed operators or suppliers are issued display permits.

Annex B Recommended Regulations for Applications for Permits for the Outdoor Display of Fireworks

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 Permit Application. The following are recommended elements to be included in the permit application for outdoor display of fireworks:

(1) Application for permit to operate a display of outdoor fireworks in conformance with the terms of _____ of the General Laws of _____ should be made in writing on forms provided by the AHJ.
(2) Such application should provide the following information:
    (a) The name, address, email address, and phone number of the individual, group, or organization sponsoring the outdoor fireworks display.
    (b) The name, address, email address, and phone number of the supplier of the fireworks, if different from that of the operator.
    (c) Evidence of financial responsibility by the sponsor of the event or festival and by the operator of the fireworks display. This could take the form of an insurance certificate or other document attesting to coverage or responsibility.
    (d) The date and time of day at which the outdoor fireworks display is to be held, with a proposed rain/wind date and time in the event the display is postponed.
    (e) The exact location planned for the outdoor fireworks display.
    (f) Confirmation of the license of the operator and the number of assistants who are to be present.
    (g) The approximate number and kinds of fireworks to be discharged.
    (h) The manner and place of storage of such fireworks prior to delivery to the outdoor fireworks display site.

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(i) A diagram of the grounds on which the outdoor fireworks display is to be held, showing the point at which the fireworks are to be discharged; the display site; the approximate distances from mortars to spectator viewing areas; the location and approximate distances of all buildings, highways, and other lines of communication; the lines behind which the audience is to be restrained; the controls that will be used to maintain audience separation; and the location of other possible overhead obstructions.

(3) Upon receipt of such application _____ days in advance of the date set for this outdoor fireworks display, the AHJ should make or initiate an investigation of the site of the proposed display for the purpose of determining compliance with these regulations in the case of the particular display.

(4) The AHJ should approve or deny the permit application with comments provided to the permit applicant. If the application is denied, the AHJ should specify the reasons for the denial so that the permit applicant can attempt to address the reasons for a denial with a resubmitted permit application.

Annex C Suggested Requirements for Operator Licensing

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

C.1 Operator Licensing Requirements.

C.1.1 A requirement of licensing is that the applicant has attained the age of 21 years.

C.1.2 A requirement of licensing is that the applicant has passed a comprehensive written examination covering state laws pertaining to the display of fireworks and this code. At the option of the issuing office, an alternate requirement can be substituted, such as acceptance of competency certification by a national organization or of licensing by another state.

C.1.3 A requirement of licensing is that the applicant has provided evidence of actively participating in the performance of at least five outdoor fireworks displays. At the option of the issuing office, an alternate requirement can be substituted.

C.2 Provisions of Operator Licensing.

C.2.1 The license should be valid for a period of 4 years.

C.2.2 Renewal of the license should be automatic upon provision of proof of active participation in at least three outdoor fireworks displays and 8 hours of continuing education during the prior 4 years.

Annex D Display Planning and Preparation

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

D.1 Approval. The outdoor display of fireworks should be conducted only when and where approved by the AHJ. To the extent required by the AHJ, written documentation describing the location and operation of the outdoor display should be submitted by the display operator, sponsor, or both for review and approval by the AHJ. The AHJ should review these documents, as well as inspect and approve the display site, prior to issuing any approval to conduct an outdoor display.

D.2 Revocation or Modification. The AHJ can revoke or restrict any approval to conduct an outdoor display whenever conditions such as site location, weather, traffic, communication, security procedures, available public protection, or other safety precautions make such action necessary to safeguard the health, safety, or welfare of the public.

D.2.1 The AHJ should determine the level of fire protection to be provided by the display operator, sponsor, or both for any outdoor display. Standby fire marshals, firefighters, and fire equipment might be required by the AHJ.

D.2.2 Wherever any condition deemed hazardous by the AHJ or the operator arises before or during an outdoor display, the display should be interrupted or postponed until the condition is corrected or the hazard is abated. Such conditions might include adverse weather conditions or crowd behavior.

D.3 Other Approvals. Public displays conducted at locations subject to multiple jurisdictions should be reviewed and approved where required by each applicable AHJ.

D.3.1 Transportation and storage of fireworks, in particular interstate transit, should be done in accordance with the appropriate federal or state regulatory authority.

Interstate commerce in fireworks is regulated in the United States by the Department of Justice, Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF). An ATF license is required to purchase fireworks classed as 1.3G explosives.

D.3.2 Public display in a harbor or on a navigable waterway should be approved by the US Coast Guard or other maritime authority.

D.3.3 To the extent required by the AHJ, public display in the vicinity of a commercial airport or heliport should be approved by the Federal Aviation Administration or other aviation authority.

A Notice to Airmen (NOTAM) should be issued to alert aircraft operators of the location and time of the public display to avoid conflicts with air operations.

D.3.4 Where necessary, permission to close roadways, divert traffic, or restrict access to roadways or other public rights of way should be obtained from the relevant authorities.

D.4 Proof of Insurance. The display operator, sponsor, or both should present verifiable proof of liability insurance of a type and amount deemed appropriate by the AHJ.

Separate insurance coverage might be required for personal injuries or accidents arising from other aspects of the event. Insurance is intended to indemnify the operator in the event of an accident arising from the outdoor display.

D.5 Site Plans.

D.5.1 Public displays are often conducted at the same site annually or on a regular periodic basis. Plans can be reused or filed with the AHJ for reference whenever an application is made.

D.5.1.1 The display operator, sponsor, or both should prepare and submit site plans to the AHJ for approval. These diagrams should be drawn to approximate scale; illustrate compliance with Chapter 5; and, to the extent required by the AHJ, contain all of the following information:

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(1) Display site — identify significant ground features, public rights of way, significant buildings or structures, overhead obstructions, parking areas, and spectator viewing areas
(2) Location of fireworks storage areas
(3) Fallout area, including dimensions
(4) North arrow
(5) Likely wind direction
(6) Location of significant roadways, including access and control points

D.5.1.2 Discharge Details. To the extent required by the AHJ, diagrams should be prepared and submitted to illustrate the general arrangement and size of mortars and the location of shell storage at the discharge site. These diagrams should include the location of the electrical firing unit.

D.5.1.3 Changes. Plans should be revised or updated as often as required by the AHJ to maintain their accuracy. Any changes in site conditions between the time plans are prepared and the time the display is conducted should be brought to the immediate attention of the AHJ and the display operator, sponsor, or both.

D.6 Operating Procedures.

D.6.1 Event Procedures. Where required, a description of the public display event should be prepared by the sponsor and submitted to the AHJ for review and approval. To the extent required by the AHJ, event descriptions should include the time and schedule of events, attendance estimates, and procedures for all of the following:

(1) Communications
(2) Weather monitoring
(3) Site security
(4) Crowd control
(5) Emergency forces notification
(6) First-aid firefighting
(7) Emergency medical services

D.6.2 Firing Procedures. If required by the AHJ, operating procedures should be prepared and submitted to the AHJ for review and approval. Where required, the operating procedures should illustrate compliance with Chapter 8 and contain all of the following information:

(1) Identification of operator
(2) Copies of applicable display personnel licenses, permits, or certificates of fitness
(3) Description of the firing method

D.6.3 Termination Procedures. If required by the AHJ, a description of the procedures to be taken upon completion of the outdoor display should be prepared and submitted to the AHJ. Where required, the termination procedures should contain all of the following information:

(1) Procedures for inspecting the discharge site and fallout area for any defective or unexploded fireworks
(2) Procedures for disposing of defective fireworks and fireworks materials

D.6.4 Emergency Procedures. Where required by the AHJ, emergency instructions should be prepared and submitted to the AHJ for approval. If required, these procedures should include all of the following information:

(1) Description of the means of alerting staff to emergencies
(2) Identification of the signal and means to notify the display operator, sponsor, or both to terminate the loading or firing of fireworks in the event a hazard arises during the outdoor display
(3) Identification of the means of notifying public emergency forces
(4) Emergency reporting instructions describing the information that should be provided to emergency operators

D.6.4.1 Where required for safety by the AHJ, a public address system should be provided by the sponsor to ensure the timely and effective notification of spectators of conditions affecting their safety. Public address announcements should be used to ensure an orderly spectator response. The following are all situations that can be anticipated at an event of this type:

(1) Fire
(2) Medical emergency
(3) Vehicle accident
(4) Crowd disturbance
(5) Adverse weather conditions
(6) Criminal activity

Annex E Sample Ordinance Adopting NFPA 1123

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

E.1 The following sample ordinance is provided to assist a jurisdiction in the adoption of this code and is not part of this code.

ORDINANCE NO. _____

An ordinance of the *[jurisdiction]* adopting the *[year]* edition of NFPA 1123, *Code for Fireworks Display*, and documents listed in Chapter 2 of that code; prescribing regulations governing conditions hazardous to life and property from fire or explosion; providing for the issuance of permits and collection of fees; repealing Ordinance No. _____ of the *[jurisdiction]* and all other ordinances and parts of ordinances in conflict therewith; providing a penalty; providing a severability clause; and providing for publication; and providing an effective date.

BE IT ORDAINED BY THE *[governing body]* OF THE *[jurisdiction]*:

SECTION 1 That NFPA 1123, *Code for Fireworks Display*, and documents adopted by Chapter 2, three (3) copies of which are on file and are open to inspection by the public in the office of the *[jurisdiction's keeper of records]* of the *[jurisdiction]*, are hereby adopted and incorporated into this ordinance as fully as if set out at length herein, and from the date on which this ordinance shall take effect, the provisions thereof shall be controlling within the limits of the *[jurisdiction]*. The same are hereby adopted as the code of the *[jurisdiction]* for the purpose of prescribing regulations governing conditions hazardous to life and property from fire or explosion and providing for issuance of permits and collection of fees.

SECTION 2 Any person who shall violate any provision of this code or standard hereby adopted or fail to comply therewith; or who shall violate or fail to comply with any order made thereunder; or who shall build in violation of any detailed statement of specifications or plans submitted and approved thereunder; or fail to operate in accordance with any certificate or permit issued thereunder; and from which no appeal has been taken; or who shall fail to comply with such an order as affirmed or modified by a court of competent jurisdiction, within the time fixed herein, shall severally for each and every

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such violation and noncompliance, respectively, be guilty of a misdemeanor, punishable by a fine of not less than $ _____ nor more than $_____ or by imprisonment for not less than _____ days nor more than _____ days or by both such fine and imprisonment. The imposition of one penalty for any violation shall not excuse the violation or permit it to continue; and all such persons shall be required to correct or remedy such violations or defects within a reasonable time; and when not otherwise specified the application of the above penalty shall not be held to prevent the enforced removal of prohibited conditions. Each day that prohibited conditions are maintained shall constitute a separate offense.

SECTION 3 Additions, insertions, and changes — that the *[year]* edition of NFPA 1123, *Code for Fireworks Display*, is amended and changed in the following respects: List Amendments

SECTION 4 That ordinance No. _____ of *[jurisdiction]* entitled *[fill in the title of the ordinance or ordinances in effect at the present time]* and all other ordinances or parts of ordinances in conflict herewith are hereby repealed.

SECTION 5 That if any section, subsection, sentence, clause, or phrase of this ordinance is, for any reason, held to be invalid or unconstitutional, such decision shall not affect the validity or constitutionality of the remaining portions of this ordinance. The *[governing body]* hereby declares that it would have passed this ordinance, and each section, subsection, clause, or phrase hereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses, and phrases be declared unconstitutional.

SECTION 6 That the *[jurisdiction's keeper of records]* is hereby ordered and directed to cause this ordinance to be published.

[NOTE: An additional provision may be required to direct the number of times the ordinance is to be published and to specify that it is to be in a newspaper in general circulation. Posting may also be required.]

SECTION 7 That this ordinance and the rules, regulations, provisions, requirements, orders, and matters established and adopted hereby shall take effect and be in full force and effect *[time period]* from and after the date of its final passage and adoption.

Annex F Fireworks Displays Conducted During Burn Bans

F.1 Mitigation Measures. In addition to the requirements of NFPA 1123, the following mitigation measures should be considered for fireworks displays that are proposed during any jurisdiction's officially designated burn bans:

(1) Any combustible areas or dry vegetation within the display site should be wet down prior to the display. This can be done with lawn sprinklers, water trucks, or other means.
(2) Two fire watch personnel should circulate throughout the area during the event and for 1 hour after the event concludes. All fire watch personnel should have a reliable source of communication to a source with appropriate firefighting equipment. The firefighting equipment can include water trucks, firefighters, or other means.
(3) Long duration effects, such as willows, waterfalls, horsetails, and effects that have the potential to come back to the ground, should be considered for removal from the display.

Annex G Informational References

G.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this code and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

G.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 101®, *Life Safety Code®*, 2024 edition.

NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*, 2023 edition.

NFPA 1122, *Code for Model Rocketry*, 2026 edition.

NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles*, 2026 edition.

NFPA 1127, *Code for High Power Rocketry*, 2026 edition.

Fire Protection Guide to Hazardous Materials, 2010 edition.

G.1.2 Other Publications.

G.1.2.1 US Government Publications US Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401.

Title 49, Code of Federal Regulations, Part 172, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans."

G.2 Informational References. The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

G.2.1 ANSI Publications. American National Standards Institute, Inc., 1180 Avenue of the Americas, 10th Floor, New York, NY 10036.

ANSI/ASME B 36.10M, *Welded and Seamless Wrought Steel Pipe*, 2018.

G.2.2 APA Publications. American Pyrotechnics Association, 4891 Long Beach Rd., SE, Suite 3, Box 291, Southport, NC, 29461.

"Celebrate Safely" (Videotape).

G.2.3 Canadian Government Publications. Natural Resources, Canada, Explosives Regulatory Division, 580 Booth Street, Ottawa, ON K1A 0E4.

The Display Fireworks Manual, Explosives Division Class 7.2.2, CANMET, Cat. No. M82-10/19911E, 2010.

G.2.4 PGI Publications. Pyrotechnic Guild International, Inc., www.pgi.org.

"Study Guide for Display Operator Training Program," 2019.

G.3 References for Extracts in Informational Sections.

NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles*, 2026 edition.

NFPA 1126, *Standard for the Use of Pyrotechnics Before a Proximate Audience*, 2026 edition.

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Sequence of Events for the Standards Development Process

Once the current edition is published, a Standard is opened for Public Input.

Step 1 – Input Stage

- Input accepted from the public or other committees for consideration to develop the First Draft
- Technical Committee holds First Draft Meeting to revise Standard (23 weeks); Technical Committee(s) with Correlating Committee (10 weeks)
- Technical Committee ballots on First Draft (12 weeks); Technical Committee(s) with Correlating Committee (11 weeks)
- Correlating Committee First Draft Meeting (9 weeks)
- Correlating Committee ballots on First Draft (5 weeks)
- First Draft Report posted on the document information page

Step 2 – Comment Stage

- Public Comments accepted on First Draft (10 weeks) following posting of First Draft Report
- If Standard does not receive Public Comments and the Technical Committee chooses not to hold a Second Draft meeting, the Standard becomes a Consent Standard and is sent directly to the Standards Council for issuance (see Step 4) or
- Technical Committee holds Second Draft Meeting (21 weeks); Technical Committee(s) with Correlating Committee (7 weeks)
- Technical Committee ballots on Second Draft (11 weeks); Technical Committee(s) with Correlating Committee (10 weeks)
- Correlating Committee Second Draft Meeting (9 weeks)
- Correlating Committee ballots on Second Draft (8 weeks)
- Second Draft Report posted on the document information page

Step 3 – NFPA Technical Meeting

- Notice of Intent to Make a Motion (NITMAM) accepted (5 weeks) following the posting of Second Draft Report
- NITMAMs are reviewed and valid motions are certified by the Motions Committee for presentation at the NFPA Technical Meeting
- NFPA membership meets each June at the NFPA Technical Meeting to act on Standards with "Certified Amending Motions" (certified NITMAMs)
- Committee(s) vote on any successful amendments to the Technical Committee Reports made by the NFPA membership at the NFPA Technical Meeting

Step 4 – Council Appeals and Issuance of Standard

- Notification of intent to file an appeal to the Standards Council on Technical Meeting action must be filed within 20 days of the NFPA Technical Meeting
- Standards Council decides, based on all evidence, whether to issue the standard or to take other action

Notes:

1. Time periods are approximate; refer to published schedules for actual dates.
2. Annual revision cycle documents with certified amending motions take approximately 101 weeks to complete.
3. Fall revision cycle documents receiving certified amending motions take approximately 141 weeks to complete.

Committee Membership Classifications[1,2,3,4]

The following classifications apply to Committee members and represent their principal interest in the activity of the Committee.

1. M *Manufacturer:* A representative of a maker or marketer of a product, assembly, or system, or portion thereof, that is affected by the standard.
2. U *User:* A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.
3. IM *Installer/Maintainer:* A representative of an entity that is in the business of installing or maintaining a product, assembly, or system affected by the standard.
4. L *Labor:* A labor representative or employee concerned with safety in the workplace.
5. RT *Applied Research/Testing Laboratory:* A representative of an independent testing laboratory or independent applied research organization that promulgates and/or enforces standards.
6. E *Enforcing Authority:* A representative of an agency or an organization that promulgates and/or enforces standards.
7. I *Insurance:* A representative of an insurance company, broker, agent, bureau, or inspection agency.
8. C *Consumer:* A person who is or represents the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in (2).
9. SE *Special Expert:* A person not representing (1) through (8) and who has special expertise in the scope of the standard or portion thereof.

NOTE 1: "Standard" connotes code, standard, recommended practice, or guide.

NOTE 2: A representative includes an employee.

NOTE 3: While these classifications will be used by the Standards Council to achieve a balance for Technical Committees, the Standards Council may determine that new classifications of member or unique interests need representation in order to foster the best possible Committee deliberations on any project. In this connection, the Standards Council may make such appointments as it deems appropriate in the public interest, such as the classification of "Utilities" in the National Electrical Code Committee.

NOTE 4: Representatives of subsidiaries of any group are generally considered to have the same classification as the parent organization.

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Following publication of the current edition of an NFPA standard, the development of the next edition begins and the standard is open for Public Input.

Submit a Public Input

NFPA accepts Public Input on documents through our online submission system at www.nfpa.org. To use the online submission system:

- Choose a document from the List of NFPA codes & standards or filter by Development Stage for "codes accepting public input."
- Once you are on the document page, select the "Next Edition" tab.
- Choose the link "The next edition of this standard is now open for Public Input." You will be asked to sign in or create a free online account with NFPA before using this system.
- Follow the online instructions to submit your Public Input (see www.nfpa.org/publicinput for detailed instructions).
- Once a Public Input is saved or submitted in the system, it can be located on the "My Profile" page by selecting the "My Public Inputs/Comments/NITMAMs" section.

Submit a Public Comment

Once the First Draft Report becomes available there is a Public Comment period. Any objections or further related changes to the content of the First Draft must be submitted at the Comment Stage. To submit a Public Comment follow the same steps as previously explained for the submission of Public Input.

Other Resources Available on the Document Information Pages

Header: View document title and scope, access to our codes and standards or NFCSS subscription, and sign up to receive email alerts.

Research current and previous edition information.

Follow the committee's progress in the processing of a standard in its next revision cycle.

View current committee rosters or apply to a committee.

For members, officials, and AHJs to submit standards questions to NFPA staff. Our Technical Questions Service provides a convenient way to receive timely and consistent technical assistance when you need to know more about NFPA standards relevant to your work.

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Information on the NFPA Standards Development Process

I. Applicable Regulations. The primary rules governing the processing of NFPA standards (codes, standards, recommended practices, and guides) are the NFPA *Regulations Governing the Development of NFPA Standards (Regs)*. Other applicable rules include NFPA *Bylaws*, NFPA *Technical Meeting Convention Rules*, NFPA *Guide for the Conduct of Participants in the NFPA Standards Development Process*, and the NFPA *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council*. Most of these rules and regulations are contained in the *NFPA Standards Directory*. For copies of the *Directory*, contact Codes and Standards Administration at NFPA headquarters; all these documents are also available on the NFPA website at "www.nfpa.org/regs."

The following is general information on the NFPA process. All participants, however, should refer to the actual rules and regulations for a full understanding of this process and for the criteria that govern participation.

II. Technical Committee Report. The Technical Committee Report is defined as "the Report of the responsible Committee(s), in accordance with the Regulations, in preparation of a new or revised NFPA Standard." The Technical Committee Report is in two parts and consists of the First Draft Report and the Second Draft Report. (See *Regs* at Section 1.4.)

III. Step 1: First Draft Report. The First Draft Report is defined as "Part one of the Technical Committee Report, which documents the Input Stage." The First Draft Report consists of the First Draft, Public Input, Committee Input, Committee and Correlating Committee Statements, Correlating Notes, and Ballot Statements. (See *Regs* at 4.2.5.2 and Section 4.3.) Any objection to an action in the First Draft Report must be raised through the filing of an appropriate Comment for consideration in the Second Draft Report or the objection will be considered resolved. [See *Regs* at 4.3.1(b).]

IV. Step 2: Second Draft Report. The Second Draft Report is defined as "Part two of the Technical Committee Report, which documents the Comment Stage." The Second Draft Report consists of the Second Draft, Public Comments with corresponding Committee Actions and Committee Statements, Correlating Notes and their respective Committee Statements, Committee Comments, Correlating Revisions, and Ballot Statements. (See *Regs* at 4.2.5.2 and Section 4.4.) The First Draft Report and the Second Draft Report together constitute the Technical Committee Report. Any outstanding objection following the Second Draft Report must be raised through an appropriate Amending Motion at the NFPA Technical Meeting or the objection will be considered resolved. [See *Regs* at 4.4.1(b).]

V. Step 3a: Action at NFPA Technical Meeting. Following the publication of the Second Draft Report, there is a period during which those wishing to make proper Amending Motions on the Technical Committee Reports must signal their intention by submitting a Notice of Intent to Make a Motion (NITMAM). (See *Regs* at 4.5.2.) Standards that receive notice of proper Amending Motions (Certified Amending Motions) will be presented for action at the annual June NFPA Technical Meeting. At the meeting, the NFPA membership can consider and act on these Certified Amending Motions as well as Follow-up Amending Motions, that is, motions that become necessary as a result of a previous successful Amending Motion. (See 4.5.3.2 through 4.5.3.6 and Table 1, Columns 1-3 of *Regs* for a summary of the available Amending Motions and who may make them.) Any outstanding objection following action at an NFPA Technical Meeting (and any further Technical Committee consideration following successful Amending Motions, see *Regs* at 4.5.3.7 through 4.6.5) must be raised through an appeal to the Standards Council or it will be considered to be resolved.

VI. Step 3b: Documents Forwarded Directly to the Council. Where no NITMAM is received and certified in accordance with the *Technical Meeting Convention Rules*, the standard is forwarded directly to the Standards Council for action on issuance. Objections are deemed to be resolved for these documents. (See *Regs* at 4.5.2.5.)

VII. Step 4a: Council Appeals. Anyone can appeal to the Standards Council concerning procedural or substantive matters related to the development, content, or issuance of any document of the NFPA or on matters within the purview of the authority of the Council, as established by the *Bylaws* and as determined by the Board of Directors. Such appeals must be in written form and filed with the Secretary of the Standards Council (see *Regs* at Section 1.6). Time constraints for filing an appeal must be in accordance with 1.6.2 of the *Regs*. Objections are deemed to be resolved if not pursued at this level.

VIII. Step 4b: Document Issuance. The Standards Council is the issuer of all documents (see Article 8 of *Bylaws*). The Council acts on the issuance of a document presented for action at an NFPA Technical Meeting within 75 days from the date of the recommendation from the NFPA Technical Meeting, unless this period is extended by the Council (see *Regs* at 4.7.2). For documents forwarded directly to the Standards Council, the Council acts on the issuance of the document at its next scheduled meeting, or at such other meeting as the Council may determine (see *Regs* at 4.5.2.5 and 4.7.4).

IX. Petitions to the Board of Directors. The Standards Council has been delegated the responsibility for the administration of the codes and standards development process and the issuance of documents. However, where extraordinary circumstances requiring the intervention of the Board of Directors exist, the Board of Directors may take any action necessary to fulfill its obligations to preserve the integrity of the codes and standards development process and to protect the interests of the NFPA. The rules for petitioning the Board of Directors can be found in the *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council* and in Section 1.7 of the *Regs*.

X. For More Information. The program for the NFPA Technical Meeting (as well as the NFPA website as information becomes available) should be consulted for the date on which each report scheduled for consideration at the meeting will be presented. To view the First Draft Report and Second Draft Report as well as information on NFPA rules and for up-to-date information on schedules and deadlines for processing NFPA documents, check the NFPA website (www.nfpa.org/docinfo) or contact NFPA Codes & Standards Administration at (617) 984-7246.

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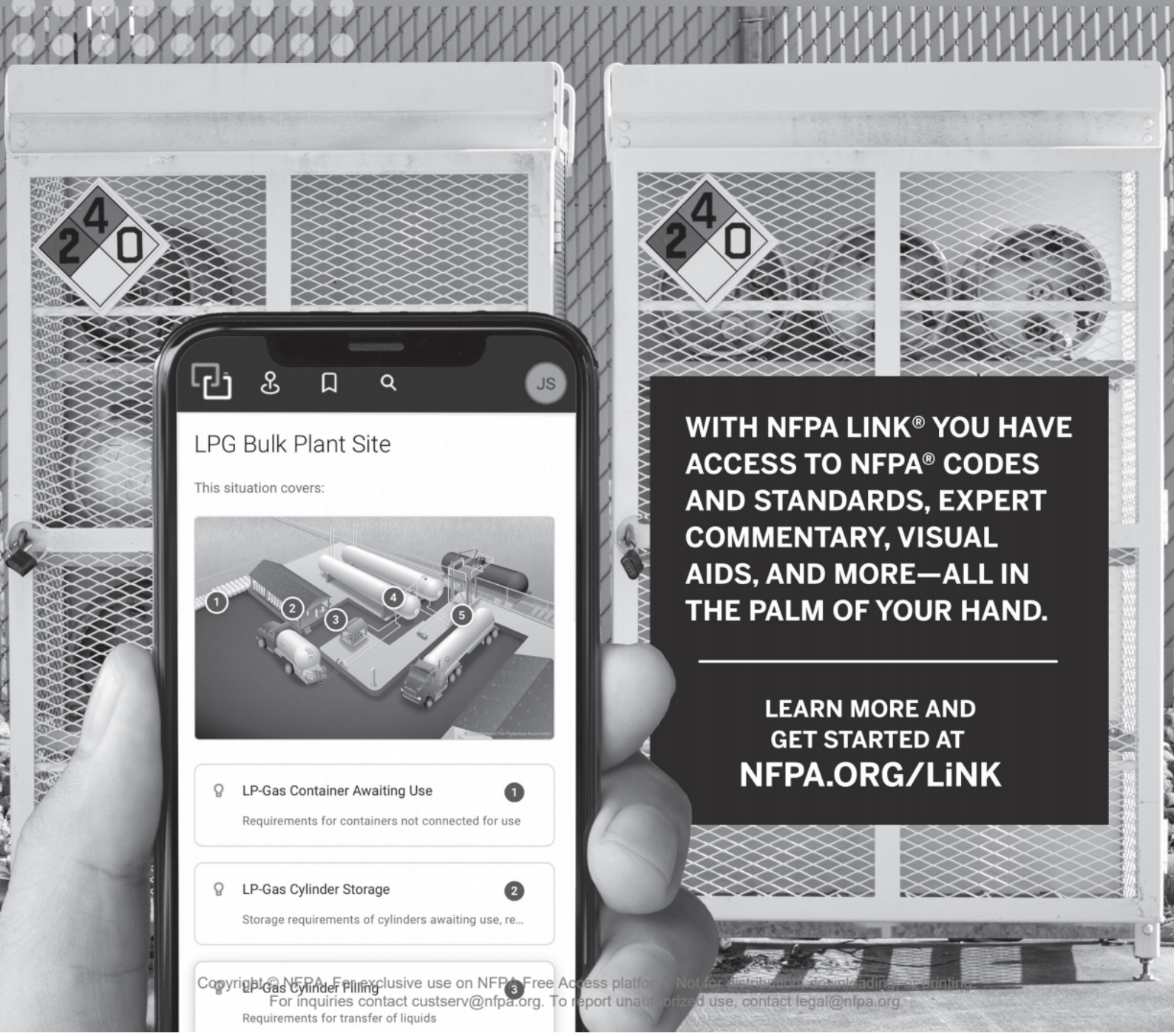

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